सत्यमेव जयते

INDIAN AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI

I.A.R.I. 6

GIPNLK—4/JDIARI/60—16-3-61—5,000

UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ZOOLOGY

VOLUME XXXV

1930

EDITORS

CHARLES ATWOOD KOFOID

JOSEPH GRINNELL

VERTEBRATE NATURAL HISTORY OF A SECTION OF NORTHERN CALIFORNIA THROUGH THE LASSEN PEAK REGION

BY

JOSEPH GRINNELL
JOSEPH DIXON
AND
JEAN M. LINSDALE

Contribution from the Museum of Vertebrate Zoology
of the University of California

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY, CALIFORNIA
1930

UNIVERSITY OF CALIFORNIA PUBLICATIONS IN ZOOLOGY
Volume 35, v + 594 pages, 181 figures in text
Issued October, 1930

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY, CALIFORNIA

CAMBRIDGE UNIVERSITY PRESS
LONDON, ENGLAND

PREFACE

Throughout the twenty-one years' existence of the California Museum of Vertebrate Zoology a major object in its program has been to obtain as fast as feasible, and to place on record, information in regard to the vertebrate animal life of the Pacific Coast region of North America, more particularly of California. While opportunity has always been grasped to add to our records from any source whatsoever or concerning any locality within our chosen domain, it has also proved possible from time to time to conduct organized field work,

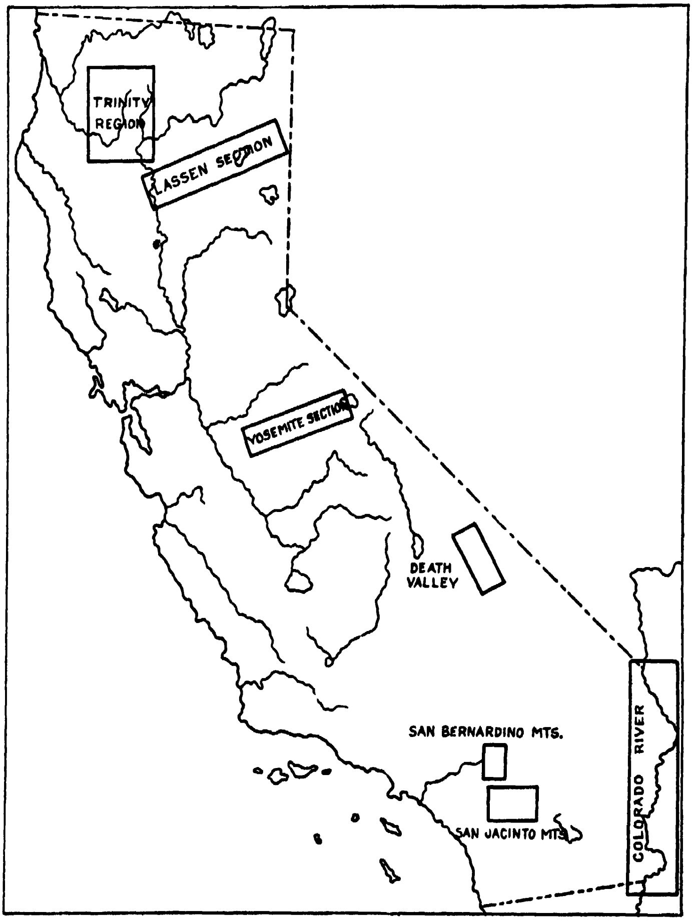


Fig. 1. Map of California showing position of the Lassen section and locations of other areas in the state which have been surveyed in a similar manner under the auspices of the California Museum of Vertebrate Zoology.

concentrated here and there where extra rapid changes of conditions due to human occupancy impend or a study of which would seem to bear importantly upon current problems in faunistics.

This present report upon a study of the vertebrate animal life of the Lassen section of northern California is one more study of that character which seems to have reached a stage to warrant publication. The other territories within the State of California which have been similarly dealt with by the Museum of Vertebrate Zoology are indicated on the accompanying map (fig. 1). This map also shows the general position of the Lassen "section."

Aside from the questions in the field of animal ecology which are stressed in the present contribution, it is felt that formal record of the mass of raw data presented herewith alone justifies publication. For environmental and faunal changes within the comparatively few years of our attention to this restricted territory have been conspicuous. In the Lassen section there are under way profound modifications of earlier conditions, modifications due directly to the increasing activities of man—grazing and over-grazing by domestic stock, lumbering, road-building, draining of lakes and other activities associated with irrigation projects, and the opening up of a new National Park to public use. Facts as to the status of species in the region at a given stage in the general faunal changes engendered by these processes will become significant in their bearing with regard to the conditions reached in the future.

It is proper here to make certain acknowledgments. And in this connection it is significant that first mention shall be made of the prime source of support of this, as well as most other, undertakings under the auspices of the Museum of Vertebrate Zoology, namely, Miss Annie M. Alexander. For, as will be noted in the statistics given elsewhere (p. 10), Miss Alexander herself, in company of Miss Louise Kellogg, did the Museum's first field work within the Lassen "section" as later outlined. This was in the region of Red Bluff, in April, 1911. Information forthcoming from Miss Alexander as a result of this initial field work, as well as of an earlier reconnoissance by her through the region, went far toward shaping the events which have led up to the present accomplishment.

Of current help in later stages of field work within or near the boundaries of Lassen Volcanic National Park was the personnel of the National Parks staff. Foremost, perhaps, in this group was Mr.

L. W. Collins, now Superintendent of the Park, who from the outset did us many good turns toward making our efforts successful. Mr. and Mrs. Creath Dale, whose ranch on Paine's Creek we made our headquarters on numerous occasions, most cordially sympathized with our aims and rendered assistance of various kinds, especially in saving for us specimens of animals that were needed but which we did not ourselves find during our own collecting in the neighborhood.

The only ones of the accompanying photographic illustrations not of our own provision are the ones credited in their legends to Mr. F. B. Loomis, of Viola. These were from photographs copyrighted by him, and he has been so kind as freely to grant their use in this publication.

Collectors in the interests of the Museum of Vertebrate Zoology, the results of whose work are incorporated in the present report, include besides the authors the following: Annie M. Alexander, Adrey E. Borell, Hilda W. Grinnell, Richard Hunt, Louise Kellogg, Chester C. Lamb, Tracy I. Storer, Harry S. Swarth, Walter P. Taylor, and Leo K. Wilson. The places and times of the activities of all of these collectors are given under "Materials," below (pp. 8–12).

As regards the tripartite authorship of this paper, Mr. Dixon's contribution has been concerned chiefly with field observation, the collecting of specimens, and photography. Dr. Linsdale has contributed not only many field observations, but he has borne the major brunt of the work of assorting and compiling the great mass of field notes which were finally accumulated; also, much of the ecologic analysis has been the result of his thought. The senior author, aside from field observation and collecting, has concerned himself primarily with the appertaining systematics and with faunal and ecologic analysis.

JOSEPH GRINNELL.

BERKELEY, CALIFORNIA,
June 24, 1929.

VERTEBRATE NATURAL HISTORY OF A SECTION OF NORTHERN CALIFORNIA THROUGH THE LASSEN PEAK REGION

BY

JOSEPH GRINNELL, JOSEPH DIXON, AND JEAN M. LINSDALE

CONTENTS

PAGE
Introduction 1
Materials 8
Some plants of the Lassen section 12
Distributional considerations 14
Life-zones of the Lassen section 88
Faunal relations 97
Populations of birds 114
Historical comment 129
Check-list of the terrestrial vertebrates of the Lassen section 131
General accounts 136
Amphibians 136
Reptiles 144
Birds 154
Mammals 446
Literature cited 579
Index 583

INTRODUCTION

At the outset of this study a narrow strip of territory was selected for intensive faunal exploration such that a considerable variety of the environmental conditions in northern California might be represented in it. Owing to the nature of our institutional interests and of our resources for study, our work in the section was further planned to deal primarily with the terrestrial vertebrate animals, namely, the amphibians, reptiles, birds, and mammals.

'We realize that complex interrelationships exist between this group of animals and the other kinds of organisms which live in the same territory. However, it seems reasonable to think that answers to general problems of natural history might be sought with greater promise of success by concentrating on some minor division rather than by making a more superficial study of the whole biota.

The aim in this report has been not to write exhaustive accounts of the animals of the Lassen section, prepared as if for an audience unacquainted in any degree with the animals concerned: this is *not* a "popular guide" to the animal life of the Lassen section. Our findings have been assorted so as to select for presentation here, for the use of the serious student, matter of real and special significance.

We have thus initially set several definite restrictions upon the content of this report. Furthermore, we have exercised care constantly to avoid entering observations or describing materials which were not obtained actually within the limits of our sharply restricted territory. Then we have, as a rule, avoided repeating, where no separate and differing significance is manifest, already well-known life-history matter for each species. For example, the general matter such as was published in the book Animal Life in the Yosemite (Grinnell and Storer, 1924) has not been repeated here. Many of the observations that are included here deal, it is true, with well-known phases of life-histories; but then, we think, they have some special significance in connection with season, place, or some other factor having to do with the natural history of the species in this particular region.

The objectives we have kept in mind in preparing this report have been, specifically, to sort out and present information that would show:

what kinds (species and subspecies) of land vertebrates are present within the section arbitrarily outlined;

the frequency of observed occurrence and the relative abundance of these kinds;

the local or habitat distribution of each kind;

the factors which determine the presence and habitat distribution of each kind;

the annual cycle of activity, in this section, of each kind; and

the definition of a way to analyze vertebrate communities and successions.

To express ourselves, as to purpose of the present contribution, still further: we are talking to the advanced student of vertebrate distribution, to the systematist who aims to correlate his naming of species and subspecies with evolutionary processes, to the student in the general field of animal ecology.

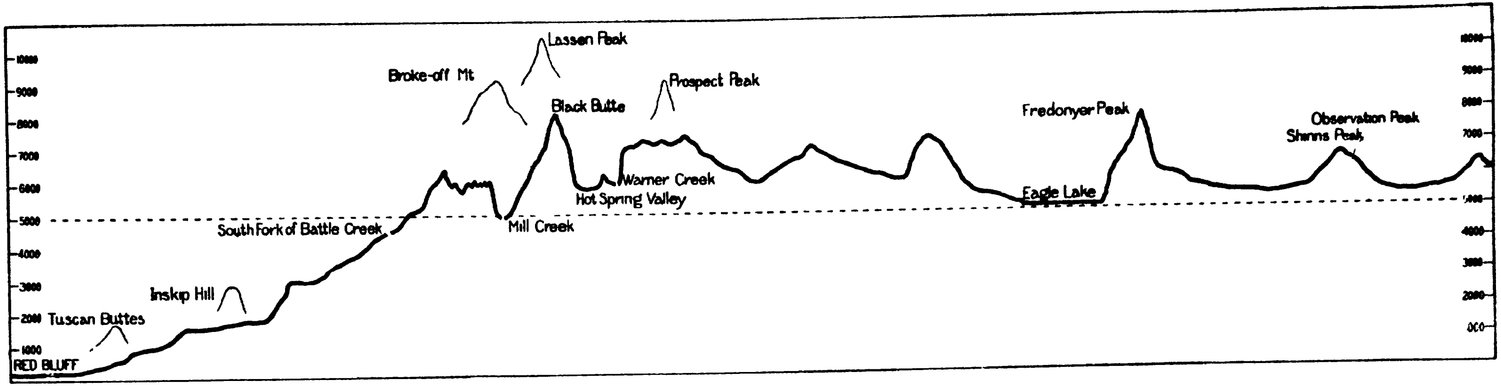


Fig. 3. Sagittal section through the Lassen section from the mid-point of one end to the mid-point of the opposite end. Elevations are so exaggerated in relation to linear distance as to bring out the fact that the volcanic mountains of the "Cascade" system stand upon the western margin of the Great Basin plateau.

THE REGION

The strip selected for survey is 24 miles wide and 124 miles long, thus comprising 2976 square miles of territory. Its position and boundaries are indicated on the accompanying maps (figs. 1 to 3). The more conspicuous topographic features within the section are the Sacramento River with the upper end of its flat valley floor at an altitude of 300 feet and less; the piedmont region; the Lassen Peak volcanic ridge with Lassen Peak itself the highest point, reaching up to 10,451 feet altitude; and the Great Basin platform at a mean level of 5300 feet, on which is Eagle Lake, the largest existing lake of the section.

The piedmont region at the western foot of the volcanic ridge is, in the section, a broad, even platform of stratified deposits gently dipping westward to the Sacramento Valley (fig. 4), from which a prominent bluff separates it. Each of the mountain streams on its way to the Sacramento has cut a deep cañon in generally southwestward course across this piedmont (Diller, 1889, p. 403).

Concerning the relationship of the volcanic ridge culminating in Lassen Peak to other mountain ranges, Diller (*loc. cit.*) points out that it appears to be a continuation of the Sierra Nevada, but that, really, "it is the connecting link between the Sierras and the Coast Range, and itself belongs geologically to the Cascade Range."

Diller (*op. cit.*) has published a full account of the geological history of the Lassen Peak district, along with a geologic map of the region. The following extracts from his account are important in the present consideration because of their bearing on present-day environments:

> Some time between the close of the Chico epoch and the beginning of the Miocene there was an upheaval west of the Sacramento Valley, and also apparently in the vicinity of the Cascade Range. The oceanic waters were thus excluded from the Sacramento Valley, Lassen Strait, and a large area in eastern Oregon, for we find that the whole region of Upper Cretaceous marine sediments was covered during the Miocene by a great body of fresh water, to which the name Piute Lake has been given. . . .
>
> The Miocene conditions appear to have continued into the Pliocene, at least as far as Piute Lake is concerned, and to have finally terminated in a great revolution which gave to the country its present aspect. [See fig. 3.]
>
> The extravasation of massive rocks occurred at various intervals in the geologic history of northern California, but the final great volcanic outburst reached its maximum near the close of the Pliocene and continued with gradually declining vigor almost to the present day.

> The upbuilding of the Lassen Peak volcanic ridge was effected by these outbursts, and at the same time birth was given to the material from which the Piedmont region was developed at the close of the Tertiary. This material was deposited chiefly under the influence of lacustrine waters, and upheaved bodily in such a way as to produce a monoclinal fold and bluff which marks the western limit of the Piedmont region.

Diller's geologic map of the Lassen Peak district shows the distribution of various types of eruptive rocks which make up such a great preponderance of the area of the section.

Fig. 4. Shingletown plateau as viewed westwardly from a point near Bailey Creek close to 5000 feet altitude and north of Broke-off Mountain. Coast ranges in background are more than sixty miles distant from position of camera. Shows the gradual slope of the terrain in the western part of the section. The horizon is not interrupted by peaks as it is in the eastern end of the section. Photograph taken by B. F. Loomis.

Concerning another geologic factor which has exerted a marked influence on present-day environmental features in the central part of the section, Day and Allen (1925, p. 2) remark that

> Lassen Peak itself was the center of fairly extensive glaciation, which reached its maximum after the period of major volcanic activity. Some of the later lavas have flowed for long distances down valleys cut and glaciated into lavas of earlier age. Solfataric action has continued down to the present time, however, and in a consideration of the eruptions since 1914 [figs. 5*a* and 5*b*], which seem to be exceptional volcanic manifestations in many ways, it is well to bear in mind that Lassen Peak itself has been relieved of its ice load in recent times. It is by no means impossible that some isostatic adjustment, consequent upon the relief of ice load, may have assisted the mechanism of the more recent outbursts.

Maps of the eastern part of the section as it appeared during Pleistocene times show that a large part of that area was covered then by lakes. The size and shape of Eagle Lake were similar to their

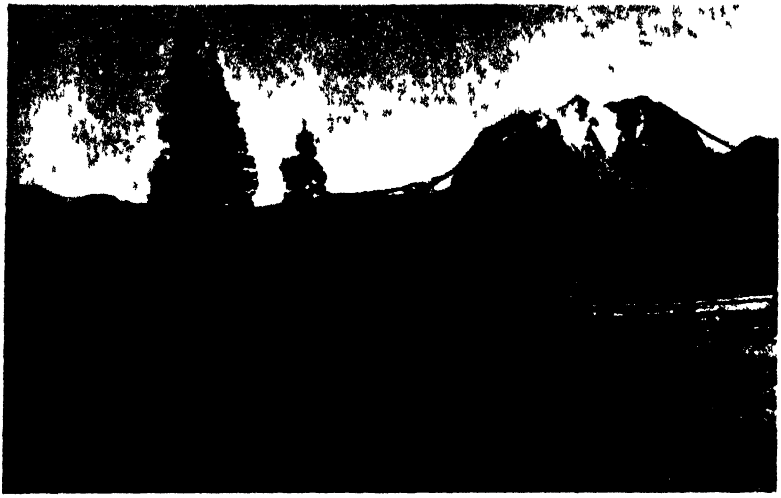


Fig. 5*a*. Jessen Meadow, on Hat Creek, and the forest between the meadow and Lassen Peak (shown in background) as they appeared in 1910, previous to the volcanic outburst from the Peak. Compare this photograph with figure 5*b*. Photograph taken by B F Loomis

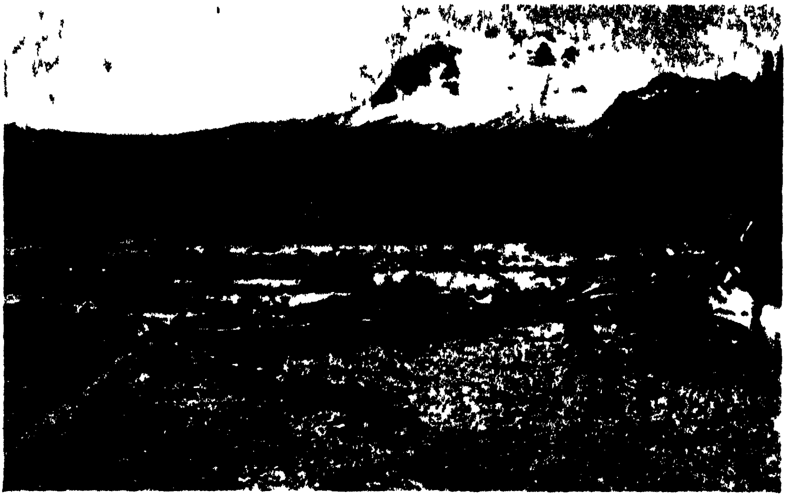


Fig. 5*b*. Jessen Meadow from same point of view as figure 5*a*. Shows appearance of the same country in 1925, ten years after the latest eruption from Lassen Peak. Cataclysmic effacement of animal habitats is here illustrated. Refer also to figure 5*a*. Photograph taken by B. F. Loomis.

present-day condition. But what is now the Madeline Plains was during the Pleistocene an extensive lake. Old shore lines may be seen now on the hills around these plains. The edge of the large Lake Lahontan, but at a much lower level, came near to the southern boundary of the section.

The climate in the Lassen section is more varied than the differences in altitude alone would indicate. In summer the general movement of the air is from the south rather than from the west. This is in part because air flowing from the west through the Golden Gate and over the San Pablo and Suisun bays strikes the Sierra Nevada range and is deflected northward. Winds in the western portion of the section in winter are northerly.

The greatest frequency of precipitation is found in the mountainous and Great Basin portions of the section on account of the showers in summer. Concerning the differing amounts of precipitation in this part of California, Willson wrote (in Summary of the climatological data for the United States, by sections) that:

> The rate of increase of precipitation with height on the western slope of the Sierra is, roughly, about 1 inch to every 75 to 100 feet, until the maximum is reached at about the 6,500-foot level, after which it decreases gradually to the summit of the range, and rapidly down the eastern side of the mountains, reaching a minimum on the plateau of the extreme northeastern portion of the state.

Within the section thermal conditions depend largely upon altitude and the configuration of the mountains (Willson, p. 1). The occurrence of frosts affects in so many indirect ways the kinds of animals being considered that the following facts should be of interest here. Nineteen years' records of the United States Weather Bureau at Red Bluff give basis for the following statements. Average date of first killing frost in autumn, December 10; average date of last killing frost in spring, February 23; earliest date of killing frost in autumn, November 11; latest date of killing frost in spring, April 12. This long growing season, 206 to 341 days, is characteristic of the Sacramento Valley portion of the section. In the eastern end of the section, on the Madeline Plains, killing frosts have been recorded in every month of some years. The longest period between killing frosts in an eight-year record was 99 days.

The accompanying hythergraphs (figs. 6 and 7) show the differences and similarities in some of the gross climatic manifestations as they are revealed by Weather Bureau records for three places which represent conditions (1) in the Sacramento Valley, (2) on the western slope somewhere close to 5000 feet altitude, and (3) on the Madeline Plains. Also, a graphic means is here available for making rough comparisons with climatic records from other regions on the North American continent.

MATERIALS

The working basis for this report has been limited almost entirely to the materials obtained in the section by field parties from the Museum of Vertebrate Zoology. These materials consisted largely of the following three sorts: notebook records of observations in the field, museum specimens, and photographs. Only a little, previously published matter of any sort has been used by us in this report, and this small portion of extraneous source consists chiefly of records of occurrence within the section itself.

In the following list of the collecting stations in the Lassen section the arrangement is in sequence from west to east. The altitudes given for each station are not meant to be more than approximations. For the most part the altitudes are from the United States Geological Survey topographic sheets. Trapping for small mammals and general field observations were carried on at each of the forty-three places listed.

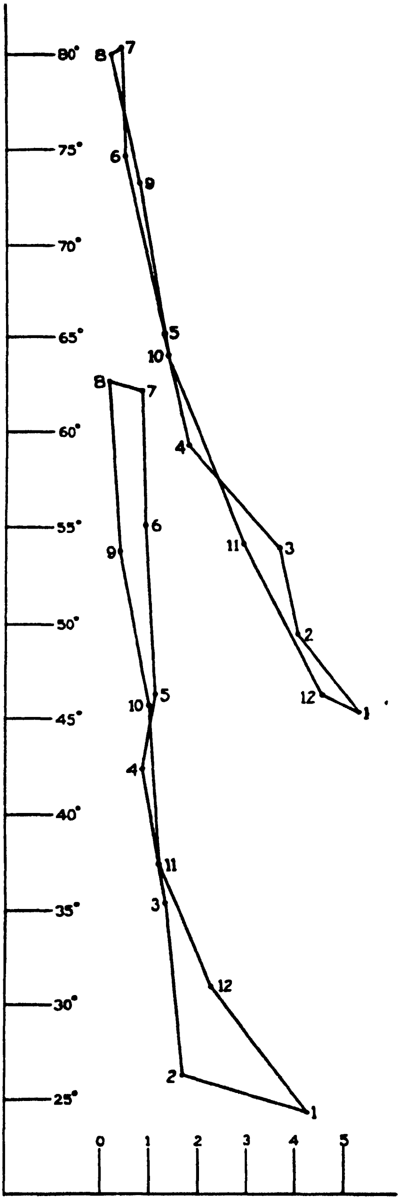


Fig. 6. Hythergraphs for Red Bluff, 300 feet altitude (upper right), and Madeline, 5270 feet. The former station represents the Sacramento Valley in the section and the latter, the Great Basin. Temperature is represented in degrees Fahrenheit, precipitation in inches. Numbers beside points on the figures designate months of the year.

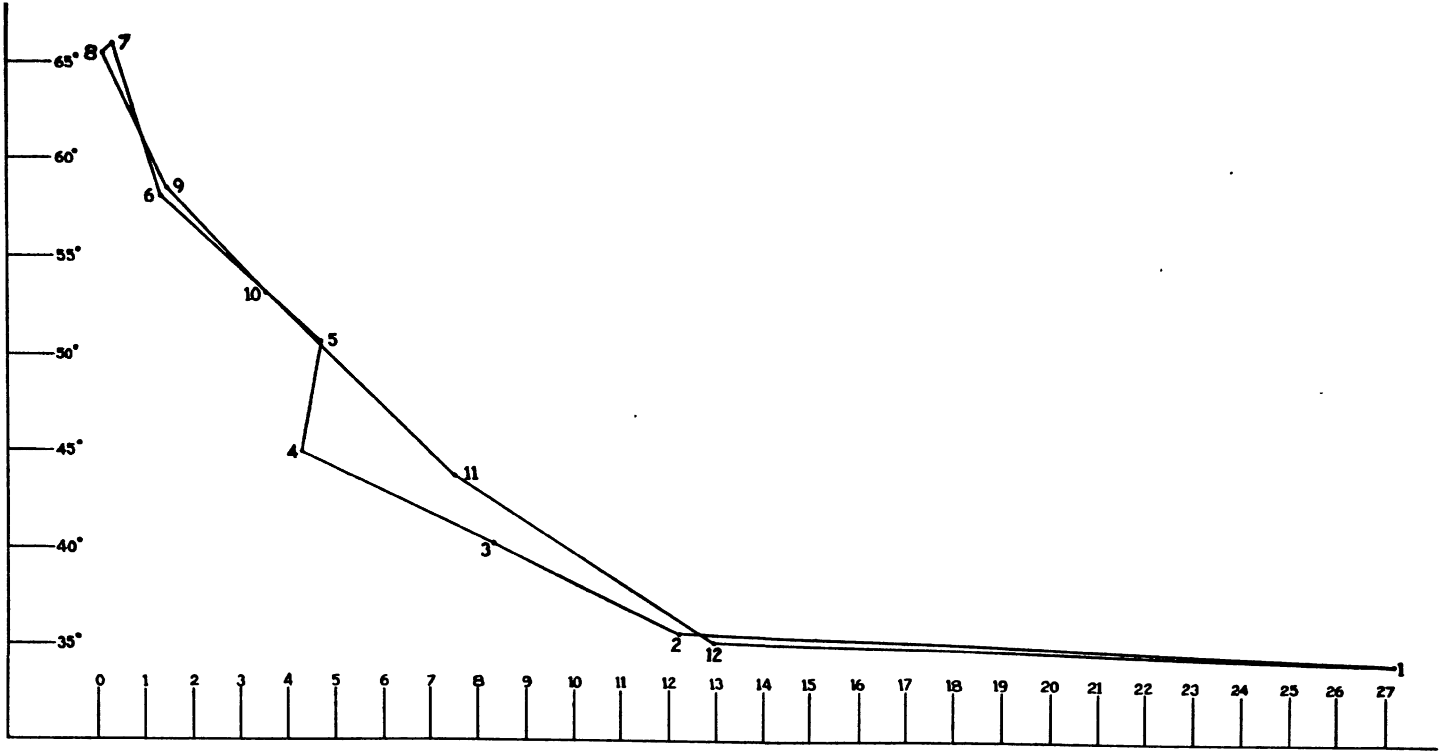


Fig. 7. Hythergraph for Inskip, 4800 feet altitude, a U. S. Weather Bureau station just outside the section to the south, in Butte County. It is thought that climatic conditions here are close to those on the same (western) slope of the section at the same altitude. Temperature is represented in degrees Fahrenheit, precipitation in inches. Numbers beside points on the figure designate months of the year.

COLLECTING STATIONS IN THE LASSEN SECTION

Ten miles north of Red Bluff, 500 feet.
Six miles north of Red Bluff, 350 feet.
Red Bluff, 300 feet.
Sisson's, 300 feet.
Coyote Creek, 270 feet.
Silva's, 270 feet.
Cone's, 270 feet.
Bloody Island, 350 feet.
Mill Creek, 260 feet.
Two and one-half miles northeast of Tehama, 400 feet.
Dale's, 600 feet.
Payne Creek P. O., 1600 feet.
Manton, 2300 feet.
Lyman's, 3300 feet.
Turner's, 3500 feet.
Battle Creek Meadows, 4800 feet.
Mineral, 4900 feet.
Manzanita Lake, 6000 feet.
Summit Creek, 5200 feet.
Two miles west of Black Butte, 6800 feet.
Lake Helen, 8200 feet.
Warner Creek at 8000 feet.
Warner Creek at 6600 feet.
Wilson Lake, 5100 feet.
Drakesbad, 5500 feet.
Willow Lake, 5600 feet.
Kelly's, 5200 feet.
Butte Lake, 6100 feet.
Bogard R. S., 5500 feet.
Eagle Lake Resort, 5200 feet.
Spalding's, 5200 feet.
Gallatin's, 5200 feet.
Slate Creek, 5700 feet.
North end of Eagle Lake, 5200 feet.
Five miles north of Fredonyer Peak, 5700 feet.
Termo, 5300 feet.
Petes Valley, 4500 feet.
Eight miles southwest of Ravendale, 5600 feet.
Secret Valley, 4500 feet.
Dransfield's, 5300 feet.
Red Rock P. O., 5300 feet.
Jones', 5400 feet.
Box Springs, 5300 feet.

In the tabulation given below is shown, for each neighborhood where work was carried on, the seasonal distribution of each observer's field-days. In all, 673 field-days were spent, by the twelve persons who took part in it, in the survey of this section, as follows: Grinnell, 167; Dixon, 138; Borell, 119; Linsdale, 108; Hunt, 51; Wilson, 50; Lamb, 16; Storer, 6; Taylor, 6; Alexander, 5; Kellogg, 5; Swarth, 2.

Red Bluff

Alexander—April 20–24, 1911; 5.
Borell—May 2–14, 1924; 13.
Dixon—April 17–18, 1929; 2.
Grinnell—May 2–14, 1924; 13.
Grinnell—December 27–January 2, 1927–28; 7.
Kellogg—April 20–24, 1911; 5.
Linsdale—December 27–January 2, 1927–28; 7.
Linsdale—April 5–16, 1928; 13.
Linsdale—April 23–24, 1928; 2.
Linsdale—April 17–18, 1929; 2.

Bloody Island

Linsdale—May 25–29, 1926; 5.

Mill Creek

Grinnell—January 5–8, 1929; 4.
Linsdale—January 5–8, 1929; 4.
Storer—June 8–13, 1912; 6.
Taylor—June 8–13, 1912; 6.

Dale's

Borell—May 18–June 4, 1924; 18.
Grinnell—May 18–26, 1924; 9.
Grinnell—December 20–31, 1924; 12.
Hunt—June 3–4, 1924; 2.

Payne Creek P. O.

Grinnell—December 22–27, 1927; 5.
Linsdale—December 22–27, 1927; 5.
Linsdale—April 22, 1928; 1.

Manton
Linsdale—May 30–June 4, 1926; 6.
Linsdale—April 17–21, 1928; 5.

Lyman's
Borell—June 6–15, 1924; 9.
Hunt—June 6–15, 1924; 9.

Turner's
Linsdale—April 25–30, 1928; 5.

Mineral
Borell—May 16, 1924; 1.
Borell—June 25, 1924; 1.
Dixon—June 12–22, 1925; 10.
Dixon—April 19, 1929; 1.
Grinnell—May 16, 1924; 1.
Grinnell—June 12–August 4, 1924; 54.
Grinnell—May 7–June 3, 1927; 28.
Grinnell—June 15, 16, 18, 19, 1927; 4.
Grinnell—December 20–21, 1927; 2.
Grinnell—June 6–12, 1928; 6.
Grinnell—June 19–25, 1928; 6.
Grinnell—July 3, 1928; 1.
Hunt—June 25, 1924; 1.
Linsdale—December 20–21, 1927; 2.
Linsdale—April 19, 1929; 1.

Manzanita Lake
Grinnell—June 17, 1927; 1.
Linsdale—June 5–12, 1926; 8.
Linsdale—June 26–27, 1929; 2.

Summit Creek
Borell—June 16–24, 1924; 9.
Hunt—June 16–24, 1924; 9.

Two miles west of Black Butte
Borrell—June 27–July 10, 1924; 14.
Hunt—June 27–July 10. 1924; 14.

Lake Helen
Borell—May 17, 1924; 1.
Borell—July 13–16, 1924; 4.
Hunt—July 13–16, 1924; 4.
Grinnell—May 17, 1924; 1.

Warner Creek, 8000 feet
Dixon—September 8–18, 1923; 10.
Wilson—September 8–18, 1923; 10.

Warner Creek, 6600 feet
Dixon—September 18–October 9, 1923; 21.
Wilson—September 18–October 9, 1923; 21.

Drakesbad
Dixon—September 5–8, 1923; 3.
Wilson—September 5–8, 1923; 3.

Willow Lake
Borell—July 19–27, 1924; 9.
Hunt—July 19–27, 1924; 9.

Kelly's
Borell—July 28–30, 1924; 3.
Borell—September 20–22, 1924; 2.
Dixon—September 20–22, 1924; 2.
Dixon—June 23, 1925; 1.
Dixon—September 2–4, 1925; 2.
Hunt—July 28–30, 1924; 3.
Swarth—September 2–4, 1925; 2.

Butte Lake
Grinnell—June 26–29, 1928; 4.
Linsdale—June 13–20, 1926; 7.
Linsdale—June 24–25, 1929; 2.

Bogard R. S.
Linsdale—June 21–23, 1929; 3.

Eagle Lake Resort
Dixon—June 20–25, 1921; 5.
Dixon—May 13–18, 1925; 5.
Dixon—May 20–23, 1925; 4.
Grinnell—June 15–16, 1928; 2.
Linsdale—June 11–12, 1929; 2.

Spalding's
Borell—October 21, 1924; 1.
Dixon—October 10–26, 1923; 16.
Dixon—October 21, 1924; 1.
Dixon—May 18–19, 1925; 2.
Dixon—May 24–28, 1925; 5.
Grinnell—June 16, 1928; 1.
Linsdale—June 13–14, 1929; 2.
Wilson—October 10–26, 1923; 16.

Gallatin's
Dixon—May 28–June 5, 1925; 7.
Dixon—June 26–July 2, 1925; 6.
Dixon—July 11–12, 1925; 2.

Slate Creek
Borell—September 26–27, 1924; 2.
Dixon—September 26–27, 1924; 2.

North end of Eagle Lake
Borell—September 28, 1924; 1.
Dixon—September 28, 1924; 1.
Grinnell—June 17–18, 1928; 2.

Five miles north of Fredonyer Peak
Borell—September 29–October 7, 1924; 9.
Dixon—September 29–October 7, 1924; 9.

Termo
Borell—October 9–13, 1924; 5.
Dixon—October 9–13, 1924; 5.

Petes Valley
Grinnell—June 8–10, 1929; 3.
Lamb—July 11–16, 1928; 6.
Linsdale—July 11–16, 1928; 6.
Linsdale—June 8–10, 1929; 3.

Eight miles southwest of Ravendale
Lamb—July 17–20, 1928; 4.
Linsdale—July 17–20, 1928; 4.
Linsdale—June 18–19, 1929; 2.

Secret Valley
Linsdale—June 15–16, 1929; 2.

Dransfield's
Borell—October 14–16, 1924; 3.
Borell—January 1–9, 1926; 9.
Dixon—October 14–16, 1924; 3.
Dixon—July 3–4, 1925; 2.

Red Rock
Grinnell—June 19, 1928; 1.
Lamb—July 21–26, 1928; 6.
Linsdale—July 21–26, 1928; 6.

Box Springs
Borell—October 16–20, 1924; 5.
Dixon—October 16–20, 1924; 5.
Dixon—July 5–10, 1925; 6.
Linsdale—June 17, 1929; 1.

The collecting of specimens formed a major part of field activity in this survey. The 3592 specimens (496 reptiles and amphibians, 1601 mammals, 1453 birds, and 34 sets of birds' eggs, usually with nests) from the section, and all now contained in the Museum of Vertebrate Zoology, served as the basis for the systematic portion of the work. In addition, numerous photographs were obtained; and many hundreds of plant specimens were preserved for certain identification, these latter now belonging to the Jepson herbarium.

Altogether, 387 kinds of vertebrate animals are considered in the accounts of species in this report. These are divided among the four classes dealt with as follows: Amphibia, 11; Reptilia, 20; Aves, 257; Mammalia, 99.

SOME PLANTS OF THE LASSEN SECTION

The following list contains names only of those plants to which we make definite reference in the accounts of the animals, as regards food, shelter, or correlated distribution. The nomenclature, both scientific and vernacular, accords with that employed in Jepson's Manual of the Flowering Plants of California (1925). Elsewhere than in this list we ordinarily use only the vernacular names of the plants—those given by Jepson, with very few exceptions as added in square brackets in this list. Repetition of the scientific names thus becomes hereafter, as a rule, unnecessary. In this connection we make personal acknowledgment to Professor Willis L. Jepson for his determination of many sheets of plants which we submitted to him from time to time.

Pinus monticola. Silver Pine.
Pinus lambertiana. Sugar Pine.
Pinus albicaulis. White-bark Pine.
Pinus ponderosa. Yellow Pine.
Pinus ponderosa var. jeffreyi. Jeffrey Pine.
Pinus contorta var. murrayana. Tamrac Pine [Lodgepole Pine].
Pinus sabiniana. Digger Pine.
Pinus tuberculata. Knob-cone Pine.
Tsuga mertensiana. Mountain Hemlock.
Abies concolor. White Fir.
Abies magnifica. Red Fir.
Libocedrus decurrens. Incense Cedar.
Juniperus occidentalis. Western Juniper.
Typha latifolia. Common Cat-tail.
Elymus condensatus. Giant Rye Grass.
Scirpus.
Veratrum californicum. Corn Lily [False Hellebore].
Salix (several species). Willow.
Populus fremontii. Fremont Cottonwood.
Populus trichocarpa. Black Cottonwood.
Populus tremuloides. Aspen.
Alnus rhombifolia. White Alder.
Alnus tenuifolia. Mountain Alder.
Corylus rostrata var. californica. California Hazel.
Quercus lobata. Valley Oak.
Quercus douglasii. Blue Oak.
Quercus dumosa. Scrub Oak.
Quercus chrysolepis. Maul Oak [Golden Oak].
Quercus vaccinifolia. Huckleberry Oak.
Quercus wislizenii. Interior Live Oak.
Quercus kelloggii. California Black Oak.
Castanopsis sempervirens. Bush Chinquapin.
Urtica gracilis var. holosericea. Nettle.
Phoradendron flavescens var. macrophyllum. Mistletoe.
Phoradendron villosum. Common Mistletoe.
Amaranthus retroflexus. Rough Pigweed.
Clematis ligusticifolia. Clematis.
Radicula nasturtium-aquaticum. Water Cress.
Ribes aureum. Golden Currant.
Ribes cereum.
Ribes montigenum.
Ribes velutinum.
Ribes roezlii. Gooseberry.
Platanus racemosa. Western Sycamore.
Holodiscus discolor. [Var. dumosa.] Cream Bush.
Rubus. Raspberry.
Rubus. Blackberry.
Rosa californica. California Wild Rose.
Cercocarpus ledifolius. Mountain Mahogany.
Purshia tridentata. Antelope Brush.
Prunus emarginata. Bitter Cherry.
Amelanchier alnifolia. June Berry [Service Berry].
Cercis occidentalis. Western Redbud.
Erodium. Alfilaria.
Rhus diversiloba. Poison Oak.
Acer glabrum. Sierra Maple.
Acer negundo var. californicum. Box Elder.
Rhamnus californica. Coffee Berry.
Ceanothus velutinus. Tobacco Brush.
Ceanothus integerrimus. Deer Brush.
Ceanothus cordulatus. Snow-brush.
Ceanothus cuneatus. Buck-brush.
Ceanothus prostratus. Mahala Mat.
Vitis californica. California Wild Grape.
Sarcodes sanguinea. Snow Plant.
Ledum glandulosum. Labrador Tea.
Phyllodoce breweri. Red Heather.
Arctostaphylos viscida. White-leaf Manzanita.

Arctostaphylos patula. Green Manzanita.
Arctostaphylos manzanita. Parry Manzanita.
Arctostaphylos nevadensis. Pine-mat Manzanita.
Fraxinus dipetala. Foothill Ash.
Eriodictyon californicum. Yerba Santa.
Salvia carnosa.
Castilleia pinetorum.
Pedicularis semibarbata.
Sambucus glauca. Blue Elderberry.
Sambucus racemosa. Red Elderberry.
Hieracium horridum.
Chrysothamnus nauseosus. Rabbitbrush.
Solidago sp.
Gnaphalium microcephalum. White Everlasting.
Helianthus cusickii.
Artemisia tridentata. Common Sagebrush.
Centaurea melitensis. Napa Thistle [Star Thistle].

DISTRIBUTIONAL CONSIDERATIONS

Considering the Lassen section as a unit it may be assumed with reason that every vertebrate species found there by us has been present for a length of time sufficient to enable it, other factors than that of time permitting, to occupy uniformly the whole area. That no species *is* distributed in this manner is shown by the records cited in the accounts we present below, although two or three species come near to behaving in this manner. Nor can the section be divided into smaller areas, each of which would correspond with the area occupied in its entirety by a sharply distinctive set of vertebrate species. It appears, indeed, that each one of the 387 species or races of vertebrates which we are here considering has a range in the section peculiar to itself. Seeming exceptions to this statement are furnished only by those species whose records are too meager to represent them adequately. A reasonable working hypothesis is, accordingly, that the combined set of factors which determines where the individuals of any one species live is different from the set of factors effective in the case of any other species.

In practice, the method used in this survey to get at the causes for differential occurrence as observed was, first, to consider the observed actual instances of restriction of individuals of each kind of animal; and, second, to compare all the records of occurrence with what we know in various respects of the portion of the section inhabited, this in an attempt to detect parallels between the extent of presence of the animal and of some appreciable environmental feature or set of features.

No instruments have been employed in our study of the environment in this section, first, because it is not known what kinds of factors are of most importance in determining the presence or absence of the types of animals we were studying. Some biotic or physiographic influences (not now measurable) may have more importance for the distribution of a particular animal species than any of the physical factors capable of being expressed in quantitative form. Then, it was impracticable for us to attempt an adequate measurement in the section, of physical conditions of possible significance such as the various manifestations of light, moisture, air movement, and heat. Therefore it seemed to us that it would be more profitable to focus our limited resources of time and equipment upon qualitative analysis.

The factors thus coming into our problem, so far as we have been able to recognize and define them, may be set forth as follows:

GENERAL FACTORS ACCOUNTING FOR THE HABITAT LIMITATIONS OF TERRESTRIAL VERTEBRATES AS RECOGNIZED BY US IN THE LASSEN SECTION

1. The inherent structural and instinctive peculiarities of each species in question.
2. Vegetation as it provides the requisite type of breeding place, forage place, food, and shelter for each species.
3. Nature of ground or rock surface as providing requisite type of breeding place, forage place, and shelter for each species.
4. Presence of water and manner of its availability to each kind of animal.
5. Altitude in its influence upon (aside from "2," "3," and "4") such conditions as warmth and moisture of the atmosphere and terrain.
6. Physiographic relationships of the section with surrounding territories, near and far, as affecting or modifying the other factors.
7. Presence or absence of other animals whose activities or numbers critically affect the food supply, individual safety, or shelter of each species in question.

HABITATS CLASSIFIED

We here make effort, first, to subdivide the areal environment of the Lassen section into smaller portions, each of which, as demonstrated by our field work, exerts important influences upon the presence and activities of a group of vertebrate species. In each case the name given the division is merely for purposes of identification.

It is not meant to imply that the object named represents the only, or even the chief, factor in the part of the habitat concerned. Second, for each named habitat an analysis indicates the chief environmental factors affecting the presence, local distribution, and major activities of the vertebrate species, as revealed by our observations in the section. This means is used for indicating some of the more clearly apparent examples of the influences of the factors already listed (see p. 15). The aim is simply to point out some of the environmental relations which might, we think, be investigated in greater detail in more intensive studies than can be undertaken in a survey of this extensive type.

- Aquatic
  - Standing water
    - Rain-pool
    - Pond
    - Lake
  - Running water
    - Spring
    - Cañon stream
    - River
- Low vegetation
  - Marsh
  - Meadow
  - Prairie
  - Sand-dune
- Brushland
  - Streamside thicket
  - Blue chaparral
  - Green chaparral
  - Scrub oak
  - Sage-brush
- Woodland
  - Broad-leafed trees
    - Willow
    - Sycamore
    - Aspen
    - Blue oak
    - Valley oak
  - Juniper
- Forest land
  - Coniferous trees
    - Yellow pine
    - Lodgepole pine
    - White fir
    - Red fir
    - Hemlock
  - Stub-forest
- Rock land
  - Rocky-plain
  - Rocky-slope
    - Escarpment
    - Talus
    - Lava flow
    - Cliff
- Human-made
  - Building
  - Road
  - Cultivated field
    - Grain
    - Alfalfa
  - Orchard

In the analysis of habitats which follows, no attempt is made to list all the species occurring in each division, nor to define and evaluate properly each environment which might be inhabited by a recognizable community of organisms. While the making of refined classifications of habitats and cataloguing the species occurring in each may be worth doing for its own sake, we have thought it more profitable in this survey to attend to the actual instances of environmental relationship which we have been able to observe in the field.

AQUATIC HABITATS

Standing water.—Habitats in which standing water is a prominent feature make up an important part of the environment for vertebrates in the Lassen section. Examples of this type of habitat occur, in one form or another, at short intervals over the whole section. The sparsest representations are found in the Great Basin portion and on the steep western slope, below the influence of passed glaciation.

Relative degrees of permanence are exhibited seasonally by the various types of standing-water habitats within the section. The greatest seasonal contrast is shown by the rain-pools in the western piedmont region. These pools (fig. 8) appear in the shallow depressions in the hardpan soil of the mesa with each winter's rains, and all of them dry up by the middle of summer. A view from the top of Inskip Hill in late December, 1927, showed an impressively large number of these rain-pools over the lower lava country to the westward.

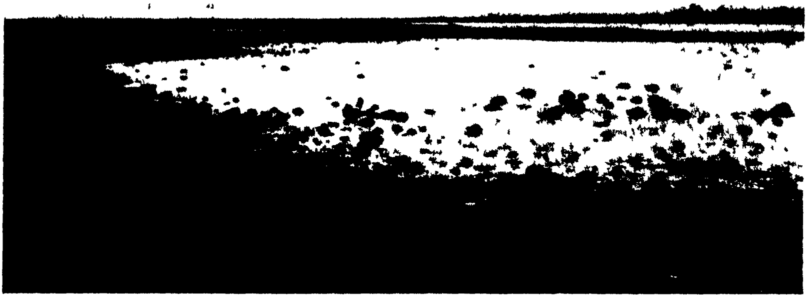


Fig. 8. Border of a large rain pool similar to others that occurred over the piedmont region. Small groups and individuals of many transient species of aquatic birds stopped here temporarily. Ducks, geese, and swans frequented this habitat in winter. The water here dried up by mid-summer of each year. Photograph taken April 18, 1929, two miles north of Dale's. Mus. Vert. Zool. no. 5874.

At several places small, artificial, deep-water ponds have been constructed and are kept in repair by persons living in the region. Of the examples studied by us in the section, the one at Elliott's on the western slope was most nearly uniform throughout the year. Strongly flowing springs kept the water level practically constant and the high temperatures made it possible for many kinds of animals to remain active through the whole year, though the aquatic vegetation turned brown in winter. Other ponds or reservoirs, such as the ones near Jones', in the extreme northeastern corner of the section, were built primarily for storing rain-water for irrigation. These reservoirs varied in size, the largest one being close to half a mile in diameter. Ordinarily each pond of this type would be filled by each winter's precipitation and the water drawn off gradually during the following summer. Usually each of such ponds would be entirely drained before the first rains in the succeeding autumn.

The remaining group of standing-water habitats in the section includes the natural, permanent lakes, numbering close to fifty, from Manzanita Lake on the west to Eagle Lake on the east. These vary in size from small woodland ponds a few meters in diameter up to Eagle Lake with an area of close to 28,000 acres. (See figs. 9 to 12.) A history of the comparatively recent geologic changes in this region would account for the basins occupied by these lakes. The water contained in them is from the winter snows that fall on the mountains. The most conspicuous seasonal feature connected with them is the circumstance that they are covered with ice during the winter months. The occupation of these lakes by most of the terrestrial vertebrates is thus limited to the summer months.

Fig. 9. A small lake typical of many which occur on the plateau east of Lassen Peak; also shows the close-growing stand of lodgepole pines which make up a conspicuous feature of the forest of the region. Photograph taken June 23, 1929, near the head of Pine Creek, southwest of Bogard Ranger Station. Mus. Vert. Zool. no. 5969.

The influences of these habitats upon vertebrates in the section may be considered together, since they affect similarly food supply and feeding places, hiding places, and breeding sites. First, with respect to food supply: Eagle Lake attracts fish-eating water birds in larger numbers than any of the smaller lakes. In a report on the fishes of the Lake Lahontan region, which included Eagle Lake, Snyder (1917, p. 184) listed five native species as occurring in Eagle Lake, as follows: *Catostomus tahoensis* Gill and Jordan, *Siphateles obesus* (Girard), *Leucidius pectinifer* Snyder, *Argosia robusta* Rutter, and *Salmo aquilarum* Snyder. In addition, several non-native species are commonly reported to have been planted there. Our notes do not include instances of specific food relationships. Aquatic insects were present in summer in the shallower portions of Eagle Lake and on some of the smaller lakes, and in sufficient numbers to form a substantial part of the food of several aquatic bird species. The dead bodies of these insect species, as well as also living ones that were emerging, were often accumulated in shore drift around some of the lakes (especially Eagle Lake, Butte Lake, and Manzanita Lake) in amounts large enough to attract feeding birds from the adjacent terrestrial habitats. In several instances this factor was doubtless responsible for an increased density of bird population in the immediately surrounding territory over that in similar land areas more remote from water.

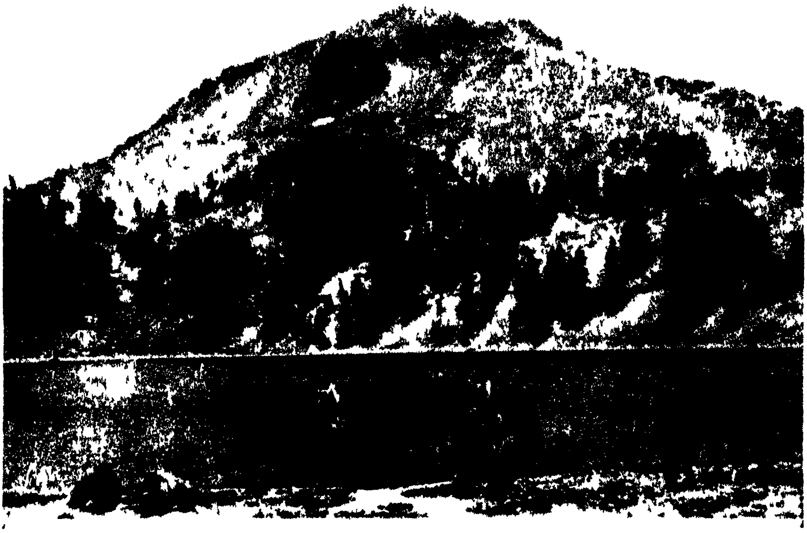


Fig. 10. Lake Helen, 8200 feet altitude; upper portion of Lassen Peak in background. Shows scattered arrangement of trees (mountain hemlocks) at this altitude and, also, the upper limits of the dwarfed trees (white-bark pines) on higher ridges beyond. Photograph taken by B. F. Loomis.

The concentration of birds to feed on aquatic life resulted in turn in increased numbers of individuals of predatory birds and predatory mammals. For example, at Eagle Lake more than usual numbers of such species as mink, raccoon, and bald eagle were accounted for by the availability of coots and ducks in large numbers. Garter snakes captured tadpoles and fishes in the shallow water at the edges of several of the lakes.

Persons living in the western part of the section told us that in winters only a few years back the temporary rain-pools on the mesa "would be packed with ducks and geese." In later years relatively few of these birds have been present. An explanation offered was that more attractive conditions in the rice fields to the southward had "drawn the ducks" there. Judging from the nature of the pools, such that there was scant opportunity for any amount of insect life or aquatic vegetation to develop, the chief use water birds could make of them would be as temporary resting places. This was borne out by the examination of the stomachs of the transient shore birds collected in spring at one of the most favored of the pools. In each case the stomach contained only sand grains; no food. However, the amount of food material available in April at the edges of the rain-pools compared with amounts on the drier portions of the mesa was sufficiently great to make these preferred feeding places and so to cause a concentration of the ordinarily dry-ground-foraging birds.

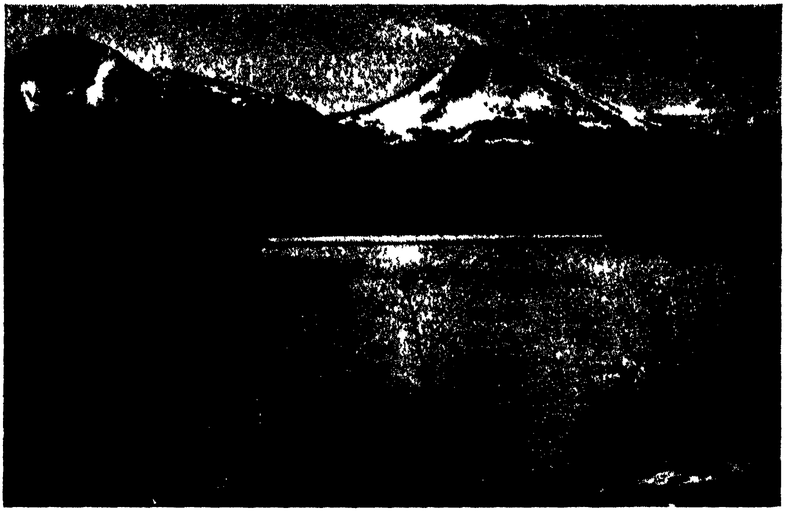


Fig. 11. Manzanita Lake. Shows areas of forest and chaparral between the lake and Lassen Peak, in background; Chaos Crags at left. Also shows diminishing upward extensions of forest on northwest side of Peak. Photograph taken in 1915, by B. F. Loomis.

In addition, the killdeer and pipit in winter and spring found suitable feeding situations here. Mud flats around reservoirs in the east end of the section provided favorable feeding places in late summer and fall.

The muskrat was able to live in Eagle Lake at times when vegetable food and suitable banks for burrowing were available together. But changes in lake level interrupted such favoring circumstances.

Some of the lakes made possible a growth of vegetation suitable for hiding places and perching places for a number of species of birds. Rocks at the edges of lakes furnished places of retreat for amphibians (*Ambystoma macrodactylum* at Emerald Lake near Lake Helen: a specific instance).

Fig. 12. Portion of southwest shore of Eagle Lake close to Eagle Lake Resort. The sandy beach in summer attracts birds from the adjacent forest to feed on the insects there. Photograph taken June 1, 1925. Mus. Vert. Zool. no. 4729.

Eagle Lake directly provided nest sites for several species of water birds by its forming a barrier of water around islands so that the nesting birds were free from molestation by land-prowling predators.

Records of the history of Eagle Lake obtained by local interests and the State Engineer and made available to us by Professor S. T. Harding of the Department of Irrigation, University of California, furnish reliable information as follows:

The first Government record of the level of Eagle Lake was in 1875, and that was of the lowest water known to date. The reading then was 91.3 feet. This figure is the number of feet above a bench mark somewhere in the vicinity. In 1905 the figure was 98.8 feet. In 1911 it was 104.8 feet. In 1916 it was 106.9 feet, the highest level known. In 1925 it had dropped, entirely through natural causes, to 95.0 feet. The irrigation tunnel tapping the lake was first opened some time during 1925. The water has continued to go down subsequent to that date, but partly, at least, thus through natural means.

This tunnel was to tap the lake forty feet below its level in 1925, but troubles encountered necessitated a vertical shaft part way through the hill and a drift from this to the lake at a level only some fifteen feet below its surface in 1925. The irrigation project under which this tunnel was put in has now (1929) almost failed financially, and until reorganization is effected there is no probability that the forty-foot level will be tapped., However, leakage has developed below the fifteen-foot level, which cannot be checked; so that uncontrolled drainage of the lake is taking place, even during the winter season when the water is not needed.

Eagle Lake is deepest at the southwest end where the depth is 62 feet, on the same basis as the preceding figures. A little lowering of the water below the present level will greatly reduce the surface and restrict the lake to the southwest arm of its present configuration, the northwest area being shallow.

Locally, among people living in the vicinity of Eagle Lake, it is believed that Willow Creek, arising in certain large springs, drains Eagle Lake subterraneously. But water analysis of those springs shows that their water does not come from the lake but from some source elsewhere not known. The Eagle Lake water shows an alkaline content different from that of the spring water. The artificial tunnel driven through the ridge to the west of the source of Willow Creek therefore constitutes a new drain upon its water in the history of the lake. It is now believed that, before the lake was tapped, its water was disposed of only through evaporation.

Altogether, the "standing water" types of habitat affect a large number of species of birds, but usually small numbers of individuals of each species. Few species of mammals are affected importantly by factors which come under this division. The effects of standing-water habitats upon reptiles in the section are slight. Several species of amphibians live in or near standing water, but the factors influencing them appear to be nearly the same as the ones they encounter in the running-water series.

Running water.—Examination of the topographic map of the Lassen section indicates that habitats connected with running water are of frequent occurrence within that territory. It happens that the two ends of the area are parts of two separate drainage systems and that the divide is almost exactly midway of the section. Thus, all the westward-flowing streams are a part of the Sacramento River drainage system along with the eastward-flowing streams which enter this

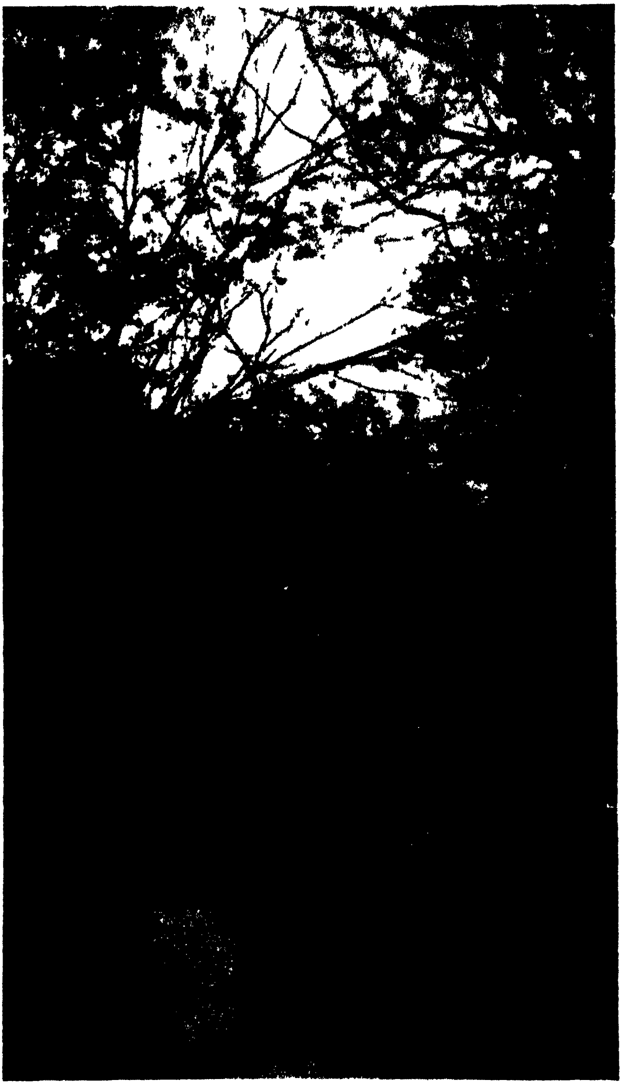


Fig. 13. One of several large springs near Paine's Creek close to the 600-foot contour line. Pacific coast newts (*Triturus torosus*) inhabited this spring. A congregation of stream-side-thicket-inhabiting birds occupied the adjacent shrubs and trees. Photograph taken April 19, 1929, at Dale's. Mus. Vert. Zool. no. 5877.

river. The streams in the eastern half of the section are a part of the Great Basin drainage system.

Many of the numerous springs in the immediate vicinity of Lassen Peak result from the volcanic phenomena of the region. Day and Allen (1925, p. 175) concluded that the hot springs of this vicinity are fed chiefly by surface water. The observations of ourselves, as well as those of Brues (1928) who investigated the animal life of thermal waters of the region, showed no instance where the water from one of these springs affected any vertebrate species of animal.

At about the altitude of Dale's, and in the territory east of Eagle Lake, we found the springs to be more important for the welfare of vertebrate animals than in other parts of the section. In many of these fresh-water springs the flow was strong at all seasons (fig. 13). The streams showed greater fluctuation seasonally than did the springs; many of the smaller streams, especially in the Great Basin region, dried up entirely in summer. At the lower altitudes the streams remained free of ice through the winter.

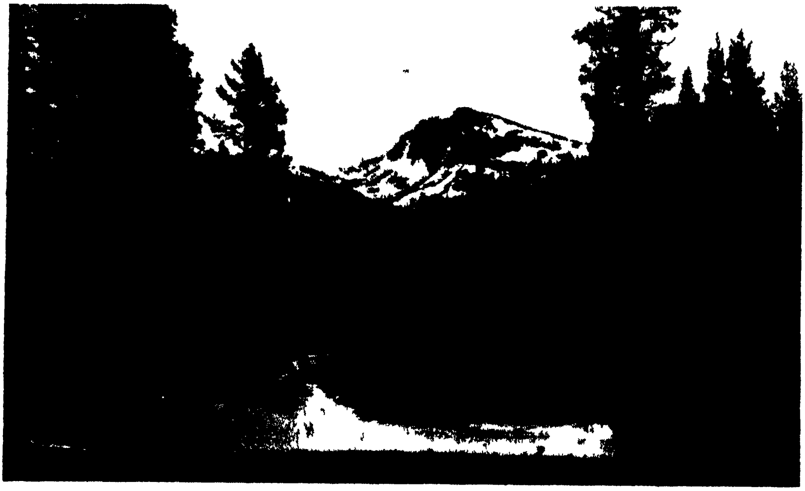


Fig. 14. South fork of Bailey Creek where it runs through Broke off Meadows. Broke-off Mountain shows in background. Example of high-mountain stream-side habitat, Canadian life-zone. Photograph taken by B. F. Loomis.

Tables compiled by Bolster and printed in "Hydrographic data for section 15, Summary of climatological data for the United States" show the seasonal fluctuations in discharge for the largest stream in the section in each of the two drainage systems represented. In both the Sacramento at Red Bluff and the Susan River at Susanville, the smallest discharges were recorded for the month of September. Ordinarily the month of greatest discharge of water of the Sacramento is March, with a rapid drop in the succeeding months. January and April are the months of greatest stream flow in the Susan River at Susanville. Lower temperatures in spring and the character of the ground cover in the eastern part of the section may in part account for the longer period of high water in the Susan River.

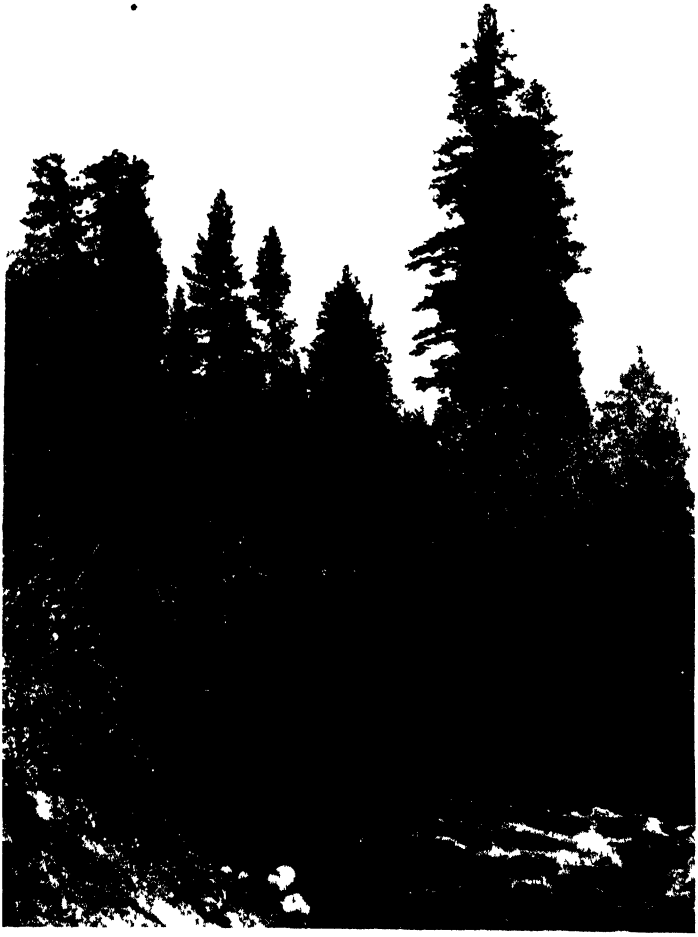


Fig. 15. Battle Creek at 4800 feet, near the edge of Battle Creek Meadows; in the willows several kinds of stream side-thicket-inhabiting birds foraged for food and nested, in summer. Photograph taken June 14, 1925. Mus. Vert. Zool. no. 4695.

Since the springs ordinarily contained little vegetation or invertebrate food material, they contributed little food for birds except indirectly as they provided moist places on slopes below them. Wilson snipe were often flushed from the edges of springs—one instance was in midwinter when all the surrounding ground was snow-covered and

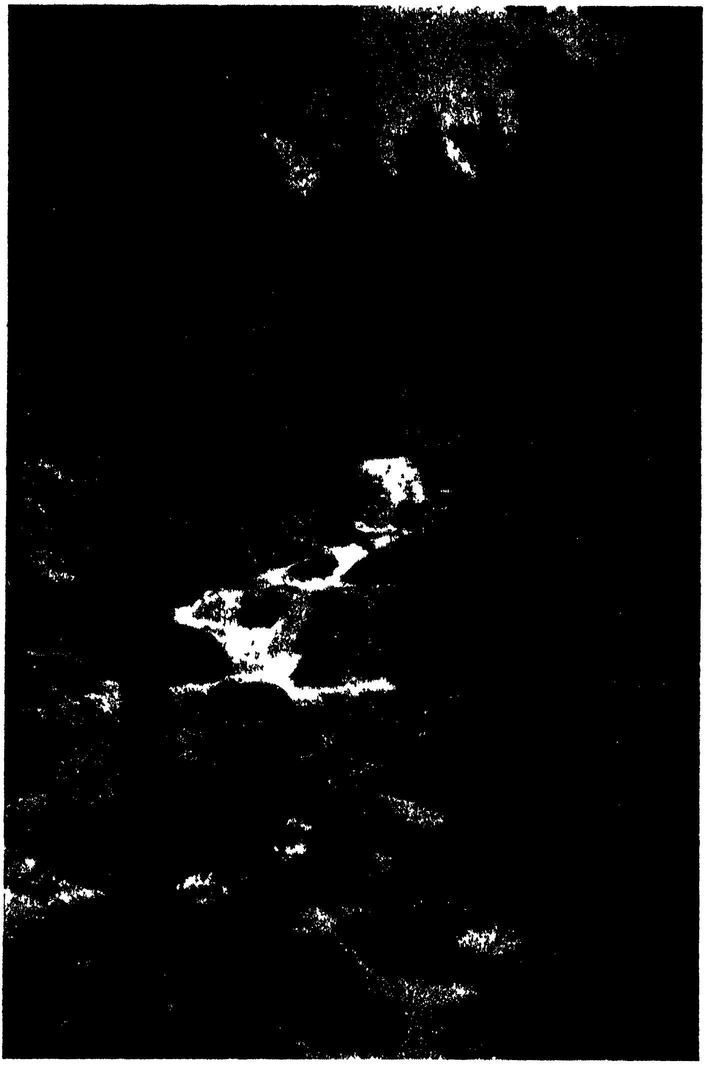


Fig. 16. Battle Creek at 4400 feet altitude, bordered sparsely by black cottonwoods and willows. Shows bouldery stream bed, a type of watercourse little chosen by birds and mammals. Photograph taken June 12, 1925. Mus. Vert. Zool. no. 4725.

frozen. One lot of newts out of a spring had eaten mollusks obtained out of the spring water. Some kinds of snakes frequented the vicinity of springs, possibly for purposes of foraging.

The most important dependence upon springs by birds was observed in the eastern part of the section, where several species visited them regularly each day to drink. Species that were definitely recorded drinking at springs are the following: sage hen, mourning dove, valley quail, western meadow-lark. This surely was an important factor in the lives of some of these kinds of birds in this arid region; if not governing their actual presence, it at least affected their daily movements.

Fig. 17. An intermittent stream representative of the ones which enter the Sacramento River from the west. The low gravel banks surround pools which last long into summer. Scattered clumps of brush and occasional willows and cottonwoods occur along the stream courses. Photograph taken April 17, 1929, at Coyote Creek. Mus. Vert Zool. no. 5873.

So large a part of the course of each cañon stream ran over steep, rocky slopes that little opportunity was given for their use by more than a very few kinds of birds. Dippers, kingfishers, and great blue herons regularly, but by different methods, foraged along these streams. The pools of quiet water were inhabited by small numbers of frogs and, at low altitudes, by newts and mud turtles. Water-shrews occurred in many of the higher streams. (See figs. 14 to 17.)

The lower portions of the creeks furnish more favorable situations for vertebrates than do the mountain streams. The slower current, larger pools more exposed to the sun, nature of soil of the stream bed, and higher temperatures make it possible for invertebrate food material of sorts suited to the needs of larger animals to develop in amounts sufficient to attract several species to forage. Almost all the vertebrates which feed in these places also hunt for food in dry-ground habitats. The trees of the borders along the lower streams are larger and have more cavities in them than is the case along the higher streams, so that favorable home sites for such species as raccoon and wood duck are available there.

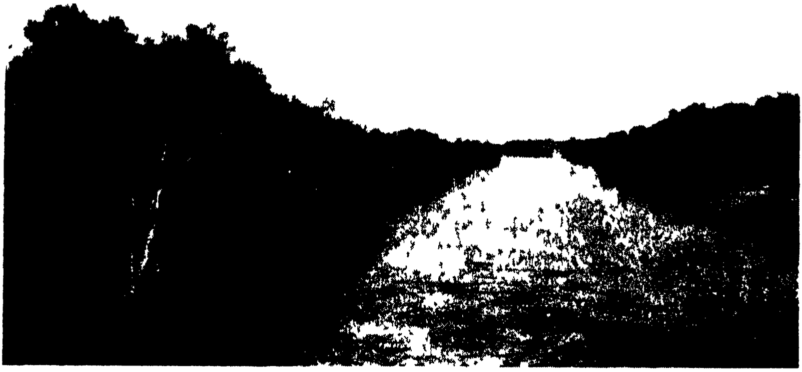


Fig. 18. Sacramento River. Shows narrow border of riparian trees on more permanent left bank and shifting gravel bar on the right. Represents a low stage of water for the spring season. Photograph taken April 17, 1929, at Red Bluff. Mus. Vert. Zool. no. 5875.

Fig. 19. Sacramento River. Shows shifting character of the stream bed; islands in the center are inundated during high water and connected with the bank at low stages. Soil thus exposed above the water is covered with vegetation which is seldom disturbed by grazing. Photograph taken April 17, 1929, at Red Bluff. Mus Vert. Zool. no. 5876.

The Sacramento River itself (figs. 18 and 19) was found to be not important as a feeding place for birds, although scattered individuals of a few species were observed foraging in its water, over the surface, or along the shore. Observations made in April and May indicated that the river exerted little influence upon the courses pursued by migrating birds. No evidence of a concentration of transient birds along the river could be made out.

The formation of islands in the river has provided places where the vegetation might grow, free from hindrance by man's activity, as well as safety from terrestrial enemies of birds. At a few places, vertical banks have been cut by the river. One of these was occupied by a nesting pair of great horned owls and by a nesting colony of cliff swallows. In another place kingfishers and rough-winged swallows were nesting.

On the whole, the running-water habitats in the section proved to have a smaller effect upon the vertebrates than their frequent occurrence and variety would predicate.

LOW VEGETATION HABITATS

Marsh.—Marshy ground is represented in almost insignificantly small amounts in the section, but every representation, even if only a few meters in extent, has some distinctive animals when it is compared with surrounding territory. Some roadside pools and the edges of the pond at Elliott's were the only marshes found in the western part of the section. Portions of Wilson Lake and Willow Lake furnished the best examples of this habitat studied in the mountains. Shallow water in protected places around the shore of Eagle Lake grew up to marsh vegetation whenever changes in water level were not too rapid. In the eastern end of the section representative marshy areas were studied along the stream in the upper end of Petes Valley and at the lower end of Red Rock Creek.

Vegetation in marshes in the section was either cat-tail or bulrush (fig. 142), growing separately or together, or certain tall, coarse, grass-like plants. Marshes of the latter type usually were drained artificially and pastured or mowed late in each summer, with the result that the plants had to grow up anew each season. The consequent lack of annually accumulating old vegetation doubtless affected unfavorably many vertebrate species.

Except when the plants grew too sparingly, the marshy tracts, even when small, furnished hiding places for some bird species. Most of these species foraged on animal matter either in mud among the plants or out on near-by open water. (See fig. 20.) At a few places seeds of the aquatic plants were available for food. Muskrats ate parts of the plants among which they lived.

The actual use of the marsh for resting and foraging was restricted for each inhabitant by its structural and instinctive equipment. As illustrations, the rails, herons, and phalaropes waded in the shallower water; the ducks and grebes swam in deeper water in places where there were open pools; another group, red-winged and yellow-headed blackbirds, marsh wrens, yellow-throats, and song sparrows,

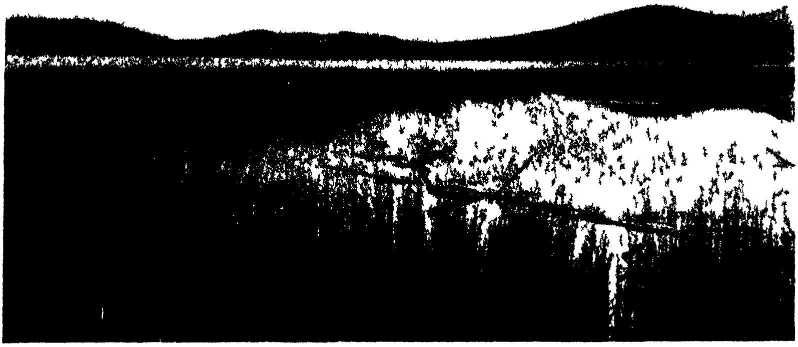


Fig 20 A portion of the marsh covered area along west side of Eagle Lake, as developed there before the recent rapid lowering of the water level Bulrushes (*Scirpus*) make up most of the emerging vegetation, which type of habitat provided favorable breeding or feeding conditions for a large population of aquatic vertebrates Photograph taken June 22, 1921, near Spalding's Mus Vert Zool no 3649

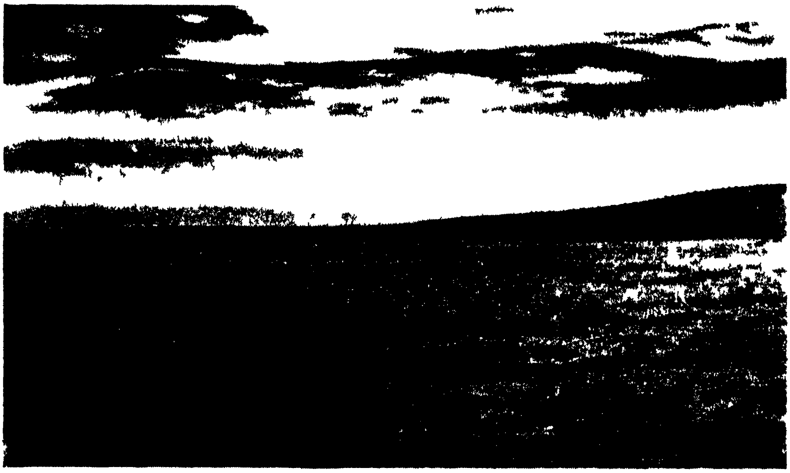


Fig 21 Meadow at the edge of the Madeline Plains Water of limited amount comes from springs at the base of the slope. Uninterrupted grazing keeps the amount of vegetation to a minimum Wild animal life was here relatively scanty Photograph taken October 15, 1924, at Dransfield's Mus. Vert Zool no 4441

were limited almost entirely for perching and foraging to the vegetation well above the surface of the water. Tree-toads often made use of the emerging vegetation for perching places above the water.

A circumstance of significance came to notice in the western end of the section where, in the pond at Elliott's previous to 1929, the growth of cat-tails and bulrushes remained through the winter and therefore provided, earlier in the season, nesting sites for red-winged blackbirds than was the case in a locality in the Sacramento bottomland where there was no preceding year's growth of such vegetation. Permanency of marsh condition may thus become a factor affecting the annual life-cycle of vertebrate species irrespective of such other factor as air temperature. Indeed, as regards temperature, it is quite

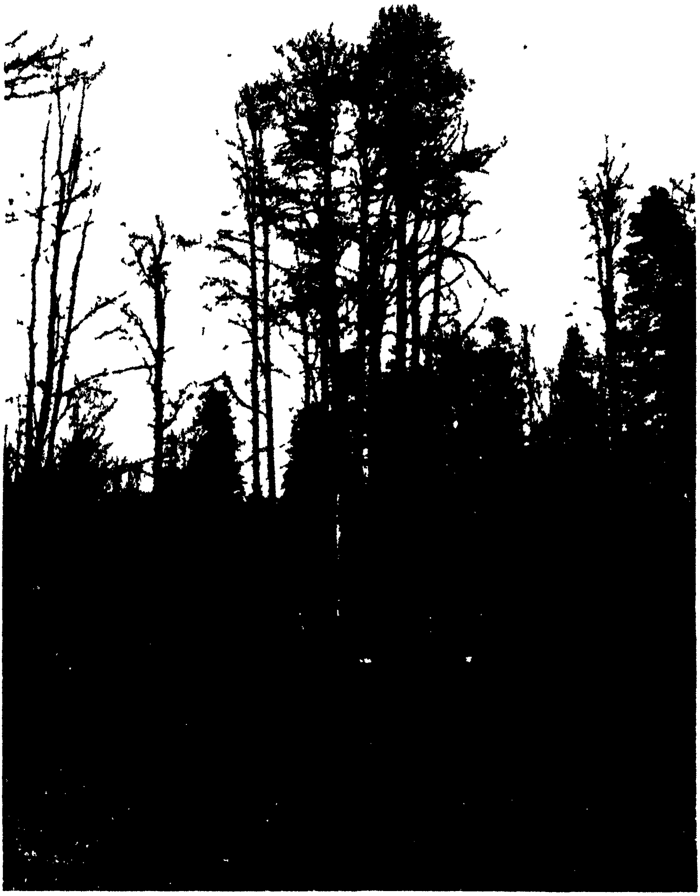


Fig. 22. Spring conditions at the border of a mountain meadow where the snow cover has just melted. The trees and willow clumps are yet leafless and the herbaceous vegetation has not yet appeared above ground. Yet some of the summer birds of this habitat arrive while the vegetation is still in this stage. Photograph taken April 19, 1929, at Mineral. Mus. Vert. Zool. no. 5886.

certain that Elliott's was cooler than the Sacramento Valley locality referred to, and where nesting was not observed under way until two weeks later.

Meadow.—We have classed as meadow those lands which are moist in early summer and which support a cover of sedges, rushes, or grasses of the less coarse types. In the mountainous part of the section are many extensive stretches of meadow especially at altitudes between 3000 and 5500 feet. Higher in the mountains the wet meadowlands are smaller in extent and are of more scattered occurrence. In the Madeline Plains (fig. 21) and Grasshopper Valley areas is considerable ground that, in seasons of more than ordinary precipitation, may be classed as meadowland.

Fig 23. Lower portion of Battle Creek Meadows. Shows willow clumps bordering stream and herbaceous vegetation on the flat ground back from the stream. Scantiness of vegetation is partly due to the especially marked drought of the year 1929. Photograph taken June 28. Mus. Vert. Zool. no. 5981.

It is characteristic of all those meadowlands above the 3000-foot contour line that in winter they are covered with ice and snow; hence they are then relatively lifeless so far as vertebrates are concerned. When the snow melts in spring the meadows are at first flooded (fig. 22). Through the summer the soil gradually becomes drier. In most years grasses and grass-like plants start growing early in the summer. By June 19, 1925, grasses in ungrazed portions of Battle Creek Meadows had reached a foot in height. The amount of growth on a meadow in a summer is limited primarily by the available supply of moisture. That is, a curtailment of the moisture supply seems to be the factor most often active, naturally, in making a short crop of grass (fig. 23).

Those mountain meadows in the section with abundant moisture and therefore abundant food in the form of grass and herbaceous plants, and insects dependent upon these, support a good number of mammals and birds for a short period each year. The species best fitted to live in meadows, and found most closely limited to them, are ones that either migrate out of the region for unfavorable seasons or which hibernate. Examples of this class of species are the following: meadow-lark, grasshopper sparrow, Savannah sparrow, Oregon ground squirrel, and Allen jumping mouse. Jack rabbits and snowshoe rabbits are adapted to live in meadows though not so closely but that they move out when conditions become unsuitable. Many other species of both birds and mammals forage in or over the meadows in summer, but these make their homes for the most part in other types of habitat that are adjacent.

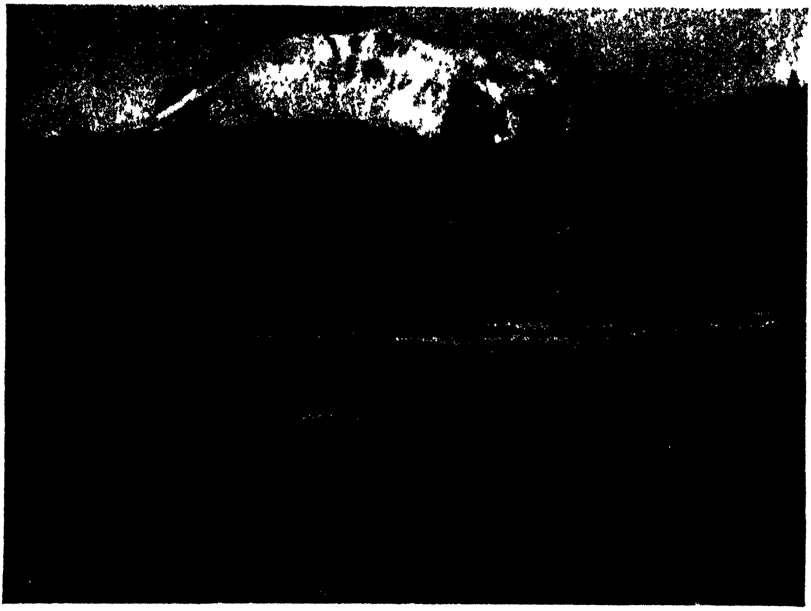


Fig. 24. Upper Kings Creek Meadow, near 7300 feet, and Lassen Peak from southeast side. Shows forest of red fir and mountain hemlock in foreground and white bark pines up ridge at left followed by the Drakesbad trail to Peak. Meadows such as this one provide abundant food and shelter for native vertebrates in years when they are not over-grazed, as here shown; in 1929 this meadow was luxuriantly grown to grass, herbaceous plants, and low willows. Photograph taken previous to 1928 by B. F. Loomis.

Grazing of the meadows too early or too heavily hastens their drying and eliminates so much of the vegetation that almost no use can be made of them by native vertebrates. (See figs. 24 to 27.)

Some of the meadows in the section have been fenced and are protected either for their hay to be cut late in the summer or for reserve pasture in case of a forage shortage. This treatment permits the vegetation to grow and stand for most of the time that, under wild conditions, it would ordinarily be used by the endemic animals.

The result of the human "use" of mountain meadows is that the greater number of the representations of this habitat are spoiled from the viewpoint of the birds and mammals adapted to use them, while on a few the conditions for the native fauna are kept nearly as good as they were before human settlement of the country. Indeed, often in the latter cases the conditions are improved by the artificial diversion of water evenly over the meadow so as to produce a more luxuriant plant growth than would have been there naturally. And this means more than "original" populations of such species as Savannah sparrows, meadowlarks, meadow mice, and Oregon ground squirrels.

Fig 25. Meadow that had been over grazed and trampled by sheep; shows how soil is eroded and carried away after the sod has begun to decay and to be cut by trampling. Food and cover for ground-dwelling native vertebrates have been destroyed. Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4479.

Prairie.—In the extreme western end of the section, prairie land forms a conspicuous part of the landscape. Also, some of the more open portions of the Madeline Plains area, at the opposite end, can be called prairies, at least when judged on the basis of requirements of the fauna native there.

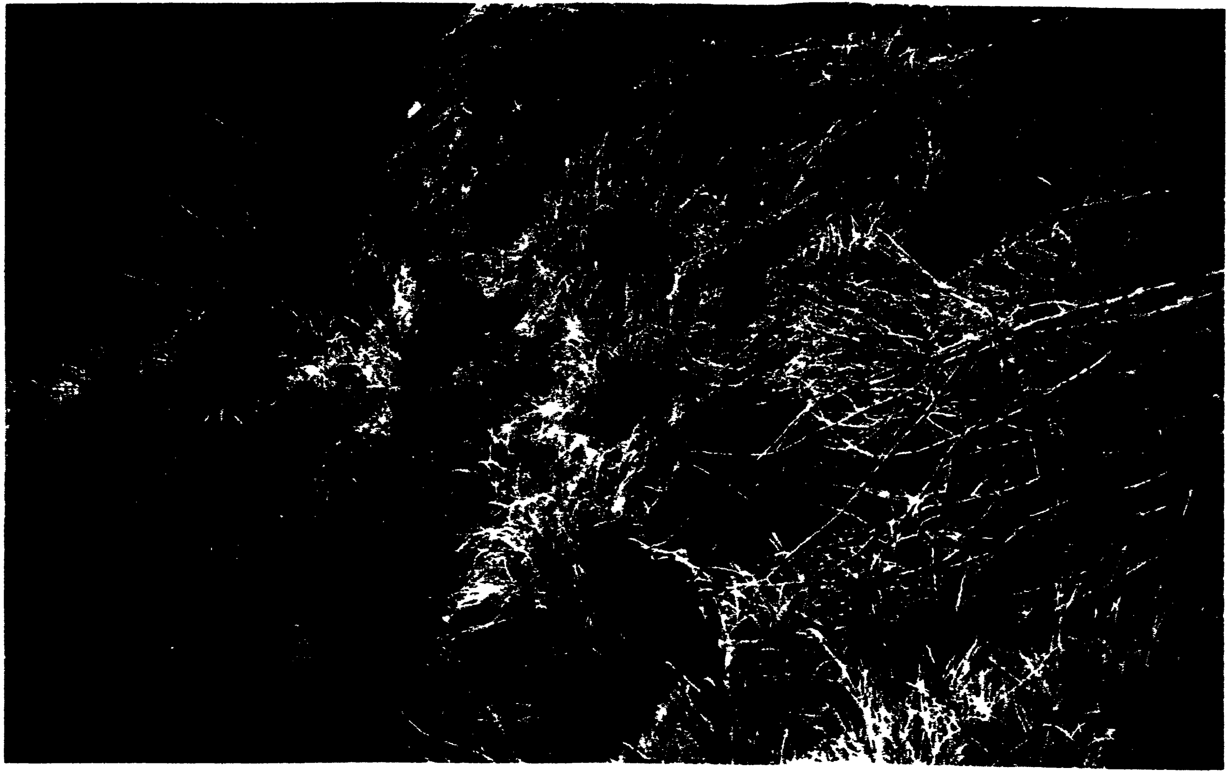


Fig. 26. Contrasted with figure 25, here is a place where barriers of rocks prevented domestic grazing animals from getting at the vegetation. Ground cover of the kind shown here furnishes both food and protective screen for ground dwelling animals. Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4480.

Most of the prairie land in the western part of the section is fit for no human use except as winter sheep range. Some of this land, as represented in the neighborhood of Coyote Creek, is flat and poorly drained so that in winter water stands in pools over much of its surface. In summer the soil becomes exceptionally dry and hard-baked and there is then scarcely any vegetation. Another type of prairie ground is exemplified in the rolling grass-covered hills ten miles north of Red Bluff. There the soil is gravelly, and during the winter and spring it supports a slightly more extensive growth of vegetation than the flat ground.

Fig. 27. A stage in cutting and erosion of a meadow that has been over grazed by sheep and thereby rendered well-nigh uninhabitable by native animals of various sorts. In the background is a stand of sage-brush and juniper typical for many of the slopes in the eastern end of the section. Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4481.

Two characteristics of all these prairie lands seem especially prominent in attracting the structural types of vertebrates which live on them. First, the absence of a high, thick cover of vegetation permits the animals which live there to see approaching dangers in time to escape by flying or running to safety. Second, the plants on the prairie with their extensive root systems provide a larger amount of food, both vegetable and insect, for ground-foraging animals than do other types of dry-ground habitat in the section.

Our observations show that more birds occur on these prairie lands in winter than in summer. This is obviously correlated with the subsistence afforded, seasonally, elsewhere as well as here.

Sand-dune.—Toward the eastern side of the Madeline Plains a strip of land about four miles wide possesses soil of a decidedly sandy constitution. On this area the wind has formed many sand-dunes. (See figs. 28 and 29.) Sand in the valleys of some of the streams in the western part of the section, while not in the form of dunes, was observed to have some distinctive influence as a habitat.

Fig. 28. Clump of giant rye grass. This type of grass grew upon areas from which the brushy vegetation had been cleared and the resulting sandy fields allowed to go unplanted. Photograph taken July 8, 1925, at Box Springs. Mus. Vert. Zool. no. 4711.

Of the kinds of mammals we found in the eastern part of the section, three were obtained only on the sand-dune covered part of the area. The Columbian kangaroo rat, the kangaroo mouse, and the gray grasshopper mouse were taken on the sandy ground exclusively. In the case of the first two species a loose substratum for burrowing was evidently important in determining where the animals could live. In this ground was a copious supply of seeds from the low-growing vegetation and also a rather rich insect fauna. The spade-foot toad was found by us in the section only on this sandy area.

In the western part of the section, whip-tailed lizards were closely limited to small sandy areas in the stream valleys.

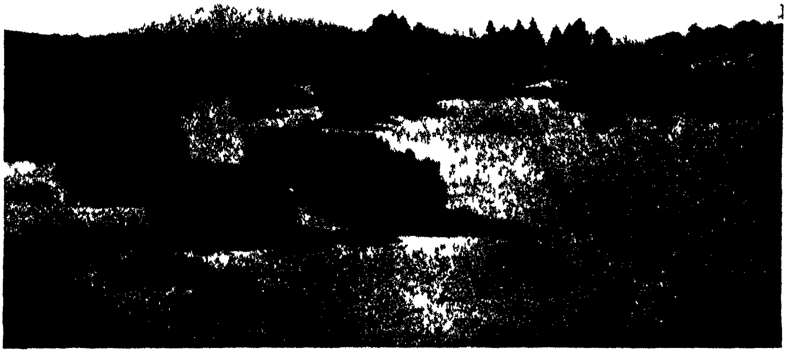


Fig. 29. Sand-dune covered area in the eastern end of the section. The loose substratum provides suitable places for burrowing, while the bushes and smaller plants furnish food of considerable amount and suitable variety for many mammals. Photograph taken October 17, 1924, at Box Springs. Mus. Vert. Zool. no. 4456.

Brushland Habitats

Streamside thicket.—In places along the Sacramento River and especially along the lower courses of westward-flowing creeks are dense thickets forming practically continuous, narrow borders. Such borders, it was observed, were limited to streams which are permanent. Many of the "streams" marked on the maps, indeed all on the west side of the Sacramento Valley, are of the seasonally intermittent type (fig. 17), at least in their lower courses. And these lacked marked representation of this type of habitat.

Wild rose bushes formed a conspicuous part of these riparian thickets. Associated plants were blackberry, grape, and in smaller numbers many plants of low, dense foliage. Broad-leafed annuals each summer filled all the openings so that each running stream was bordered in the lower part of its course by a belt of nearly impenetrable growth. (See figs. 30 to 32.)

The dense nature of these tangles appeared to make them useful as places of refuge for several bird and mammal species which foraged widely. Several kinds of birds and mammals would, when disturbed by an observer, hurry for the nearest available cover of this type, where they would promptly be lost to view. Some species were apparently so closely limited to the near vicinity of dense brush that this seemed an important factor in determining their presence.

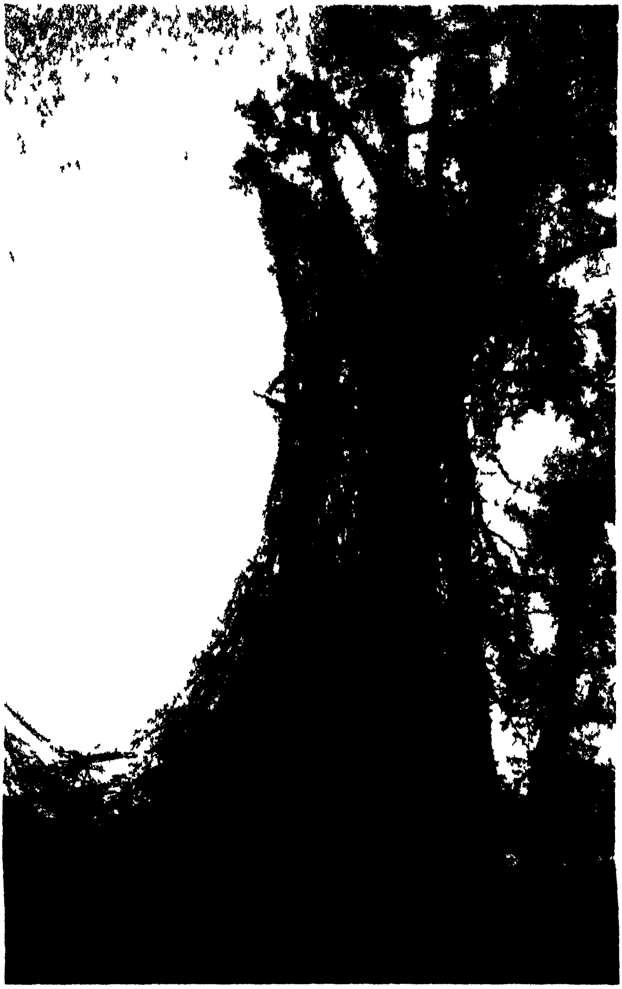


Fig 30 Dense tangle of grapevines overgrowing valley oaks in border of a Sacramento River bottomland creek. Such heavy growths of vine as this, even when leafless as shown here, provide shelter, food, and home sites for many kinds of vertebrate animals. Photograph taken April 17, 1929, at Cone's. Mus Vert Zool. no. 5878

Food of several sorts was available in quantity in this type of habitat. In summer the abundant foliage harbored an abundance of insects compared with the other ground in each vicinity. In winter many of these insects were available, in some stage, in the accumulation of leaf litter on the ground. In addition, many of the bushes and vines produced fruits that the birds ate in large amounts. Enough weed seeds were produced to provide an important source of food. Several species of rodents and lagomorphs in the western part of the section found in stream-side thickets vegetable material sufficient in amount and suitable in kind for their entire subsistence.

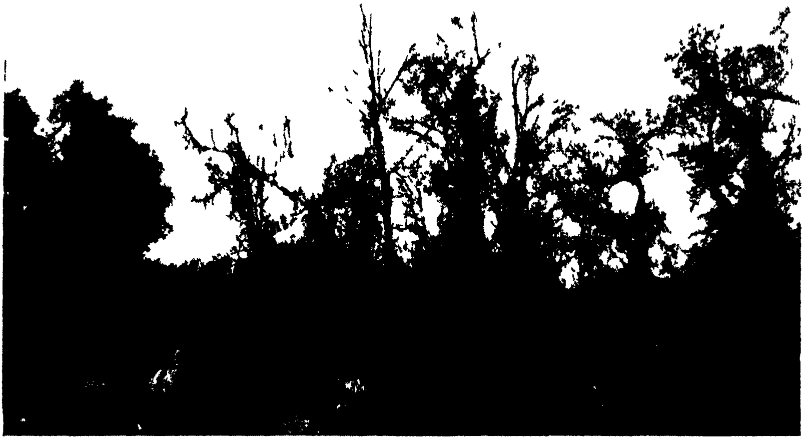


Fig. 31. Thickets and trees which contribute to the luxuriant vegetation of the stream borders in the western part of the section. The long growing season and the plenteous supply of water combine to favor this extensive plant growth which is of such variety that many kinds of animals find suitable living quarters here. This kind of habitat occupied a small area and it was one of the most densely populated with vertebrates of any in the section. Photograph taken April 18, 1929, near Dale's. Mus. Vert. Zool. no. 5879.

We found in the section a surprisingly small number of birds' nests within stream-side thickets. However, the number of pairs of birds present which ordinarily nest in such situations was large. Hence, it was presumed that many suitable sites were available there, whose employment was not apparent because of the effectiveness of the heavy cover for concealment.

Blue chaparral.—A large part of the upland of the piedmont region in the section is covered brokenly by shrubby plants that, in the aggregate, we have called blue chaparral. The color of the whole vegetation in this belt has a distinctly blue cast when compared with the belt of bright-green-appearing plants higher in the mountains.

In gross appearance this chaparral varies from sparse stands where the clumps of bushes are scattered far apart over the rocky plain to dense, nearly impenetrable tangles on the ground most favorable to plant growth. In many places trees are scattered among the bushes so that, in these places, the influences of the two types of habitat, chaparral and woodland, overlap.

Fig. 32. Stream-side thickets and drift accumulations, viewed from the stream bed. Shows where the ground foragers of this habitat ordinarily gleaned their food. Photograph taken April 17, 1929, at Cone's. Mus. Vert. Zool. no. 5880.

Buck-brush makes up the bulk of the woody plant growth in this area (fig. 33). The larger proportion of this species goes along with a more open type of plant cover. In the denser stands other kinds of plants are important. Poison oak, coffee berry, white-leaf manzanita, and Parry manzanita are the most important of the shrubs associated with buck-brush.

These shrubs, in combination, furnish food for large numbers of birds and mammals. First, large amounts of foliage and bark are available close to the ground for such animals as eat that kind of vegetable food. The dense foliage and the abundant flowers produced attract enough insects to provide worth-while forage for many insect feeders. Fruits are borne in sufficient variety and amount, and over a long enough period each year, to make up an important food source for seed and fruit eaters. The dense cover provided close to the ground proved to be an important factor favoring presence, in the cases of several species of birds and mammals. This characteristic was taken advantage of by some animals whose foraging was done largely on the ground in the spaces between the brush clumps.

Fig. 33. Clumps of buck-brush of different ages; young plants are in foreground. This is an important shelter and food plant for birds and mammals in the western part of the section. Too heavy toll by stock, such as takes place over large areas in this region, tends to destroy these plants faster than they are able to replace themselves. Photograph taken April 19, 1929, at 3000 feet altitude on Lassen Highway. Mus. Vert. Zool. no. 5883.

On January 1, 1928, large clumps of Parry manzanita north of Red Bluff were in full bloom and insects swarmed about the flowers despite the cold drizzle of rain that fell all that day. Anna hummingbirds were seen at that season only in the vicinity of these bushes. (See fig. 34.)

Buck-brush in the vicinity of Dale's was in fruit in May, 1924. Linnets, goldfinches, and possibly rodents were feeding on the fruits. The foliage was being eaten by cattle and sheep, and out on the sheep range many clumps of this brush plant had been reduced to mere dead-stalks. The stems, often several inches in diameter at their bases, weather away slowly, leaving "skeletons" here and there to mark the sites of former clumps. It is doubtful if, on the open range where sheep and cattle graze, young plants of this ceanothus can ever attain to the status of regular clumps, or even get started. Ordinarily, this plant provides the best winter forage for deer, of any in the region. This ceanothus is a great shelter plant for birds, mice, and quail; and jack rabbits have their forms in the shade of its clumps; but under present humanly managed economic conditions it seems doomed to disappear and with it, locally, a train of animal dependents. (These comments were set down [Grinnell, MS] concurrently with observation in 1924.)

Fig. 34. Parry manzanita, one of the important chaparral plants in the hills north of Red Bluff. Anna hummingbirds (*Calypte anna*) were found about blossoming clusters of this plant in January. Photograph taken April 18, 1929, seven miles northeast of Red Bluff. Mus. Vert. Zool. no. 5881.

Green chaparral.—The general area in the section occupied by green chaparral is practically the same as the general area covered by the coniferous forest. The plant species making up this chaparral occur in two ways: as scattered clumps beneath the forest trees and in small openings, and in close, dense, extensive growths which cover whole ridges and broad slopes where there are few or no trees.

The most important shrubs making up this type of habitat are certain species of *Arctostaphylos* and *Ceanothus*. Green manzanita, forming low and widespreading clumps sweeping the ground, is conspicuous in many places in the mid-altitude portions of the section. Tobacco brush is another shrub which tends to be gregarious, forming in places pure stands many acres in extent. Deer brush is a widely branching shrub often spreading so as to make a clump much wider than high. The slender drooping branches end in pliant branchlets. Perhaps the most important ceanothus of this region is snow-brush (figs. 35 and 36). This shrub when growing in nearly pure stands forms a dense, low mat one to four feet in height. The small-stemmed branches are crooked and thorny. The rigid framework close to the ground is often so dense and intricately woven as to permit a person to walk over the tops of the bushes. Otherwise progress through the tangle is difficult and painful for anyone on foot.

Fig. 35. A clump of snow-brush in spring just after most of the snow had melted. The litter beneath the overhanging sprays of this plant provided suitable forage places in summer for many kinds of birds and mammals. Several species of birds placed their nests in the thorny boughs of this plant. Photograph taken April 19, 1929, at Mineral. Mus. Vert. Zool. no. 5882.

Various other kinds of low-growing shrubby plants of the region contribute in many ways to the variety in appearance and to the usefulness to birds and mammals (the vertebrate classes chiefly concerned here) of this "green chaparral."

The plants making up the green chaparral provide food for a large proportion of the birds and mammals of the mountainous parts of the section. Plant-feeding mammals whose activities are limited to a stratum near the ground surface find suitable food in abundance in the foliage, bark, or fruits of one or more of these shrubby plants. Examples of these types of feeders are the deer, chipmunk, golden-mantled ground squirrel, snowshoe rabbit, pocket gopher, and, possibly, white-footed mouse, as well as others which forage more extensively in other types of habitat (figs. 37 and 38). Fruit-eating birds were observed in the latter part of the summer to feed extensively on fruits of certain of the chaparral plants.

Fig. 36. A blossoming clump of snow-brush. Flowers and foliage of this plant supply many insects as well as vertebrate animals with food. This is one of the most favorable chaparral plants in the region for the needs of many vertebrates. Photograph taken June 24, 1925, at Kelly's, on Warner Creek. Mus. Vert. Zool. no. 4680.

Another and large group of bird species found sufficient food, for their support during the whole summer, in the insects which they obtained about these plants. Our records indicate that many birds come, as the summer advances, to the green chaparral to feed, not only from closely adjacent habitats but also from places lower on the western slope of the mountains. This latter class makes up a large part of those birds which move "up-mountain" after their breeding season in the lowlands.

That the food supply for birds is large in the green chaparral is attested by the fact that in extensive areas of this vegetation there are almost no "territories" not occupied by breeding pairs of birds. In other words, for each species concerned the breeding population approaches a maximum in these areas.

Several of the green chaparral plants seem particularly well adapted for furnishing nest sites for low-stratum-nesting birds. For those birds which place their nests on the ground the dense branchwork and foliage of the shrubbery make an effective screen as well as an entanglement which tends to keep prowlers away, or to thwart their efforts. Not only do these plants hide the nests or dens of many animals but they shelter the animals themselves when foraging, from the view of predators and also from the intense sunshine which strikes some of the exposed mountain slopes.

Fig. 37. Fruits of chinquapin. Several kinds of diurnal rodents were observed to eat the contents of these burs. Photograph taken September 4, 1925, at Kelly's. Mus. Vert. Zool. no. 4719.

Seasonally the green chaparral undergoes changes, as influencing animal life, more marked than the ones we noted in most of the other habitat types. For more than half of each year at the higher levels these chaparral plants are covered with snow so that the only vertebrates which can make any use whatever of the plants are those few mammals which tunnel through the snow and use the plant stems as food.

By May 8, 1927, some of the green manzanita in the great expanses of chaparral on the ridges, at 6500 feet altitude, southwest of Brokeoff Mountain, was in full bloom. At that time snow banks still remained there. The big manzanita tracts were as yet birdless. At lower altitudes, where the snow had been gone longer, a few chaparral-frequenting birds were by then established. However, even there, their numbers were few when compared with the bird population observed in exactly the same places in mid-June; or else, in early May, in part perhaps, the birds had been exceedingly quiet and reclusive, and hence overlooked. As early as April 19, 1929, some individuals of several species had already arrived. Early in September or, at the latest, in October the chaparral-inhabiting birds move out of the mountains, and a little later the plants are again weighted down and completely covered with snow.

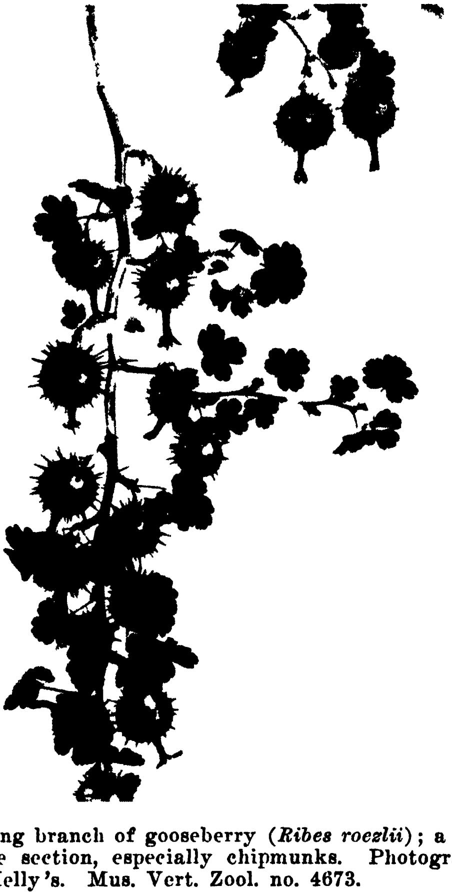


Fig. 38. A fruiting branch of gooseberry (*Ribes roezlii*); a food source for many rodents in the section, especially chipmunks. Photograph taken September 4, 1925, at Kelly's. Mus. Vert. Zool. no. 4673.

A large part, if not all, of the area now occupied by pure stands of chaparral (fig. 39) was at one time or another covered with forest. The extensive cutting of forest in recent years, the fires which have

Fig. 39. Expansive belt of chaparral south of Manzanita Lake. Shows unbroken cover typical for many slopes in the central Lassen section. Also, shows some scattered trees and stubs such as provide singing perches for chaparral nesting birds. Most conspicuous shrub plants here are green manzanita, tobacco brush, and chinquapin. Photograph taken June 27, 1929. Mus. Vert. Zool. no. 5978.

Fig. 40. Hat Lake, formed on West Fork of Hat Creek by mud flow of 1915, as it appeared in 1928. On the near-by slopes are considerable patches of chaparral, one of the early habitats in the succession which is taking place on this land after destruction of the trees by volcanic activity in 1915. Photograph taken by B. F. Loomis.

taken place more frequently or more severely with the human settlement of the region, and the destruction of forest by recent volcanic action (fig. 40) have resulted latterly in a general reduction of the forested area and a corresponding extension of the chaparral. While the natural sequence of changes would result in a fairly quick replacement of the forest, the existing conditions in certain places are such that reforestation is taking place very slowly or not at all. However, in at least one locality in the section, the vicinity of Turner's, the forest growth is appreciably increasing at the expense of the chaparral plants. Indeed, in this neighborhood complaint was heard that the country was being ruined for grazing by permitting and encouraging the replacement of the tree growth!

Fig. 41. A single clump of tobacco brush in the borderland between forest and chaparral. Photograph taken June 27, 1929, near Manzanita Lake. Mus. Vert. Zool. no. 5980.

The green chaparral type of habitat, even though conditions in it are fairly uniform, supports a considerable number of vertebrate species and also large numbers of individuals of almost every one of these species. One feature that is conspicuously absent from the extensive tracts of chaparral, but which is taken advantage of when it is present, is the availability of singing perches at some height above the low growth. There appears to be a denser population of chaparral inhabitants at the edges of forest (fig. 41) or where trees of small stature are scattered about between tracts of chaparral than elsewhere.

Scrub oak.—We studied examples of scrub oak type of chaparral on the slopes of Inskip Hill and on the uncultivated lands in the neighborhood of Manton. Inskip Hill is more heavily clothed with brush plants and small trees than any of the surrounding country, and its chaparral is distinctly green rather than blue by reason of the predominance of scrub oak, a green-leafed manzanita, and coffee berry over buck-brush and digger pine, although both the latter are there too. There are also present on the lower western lava slopes a

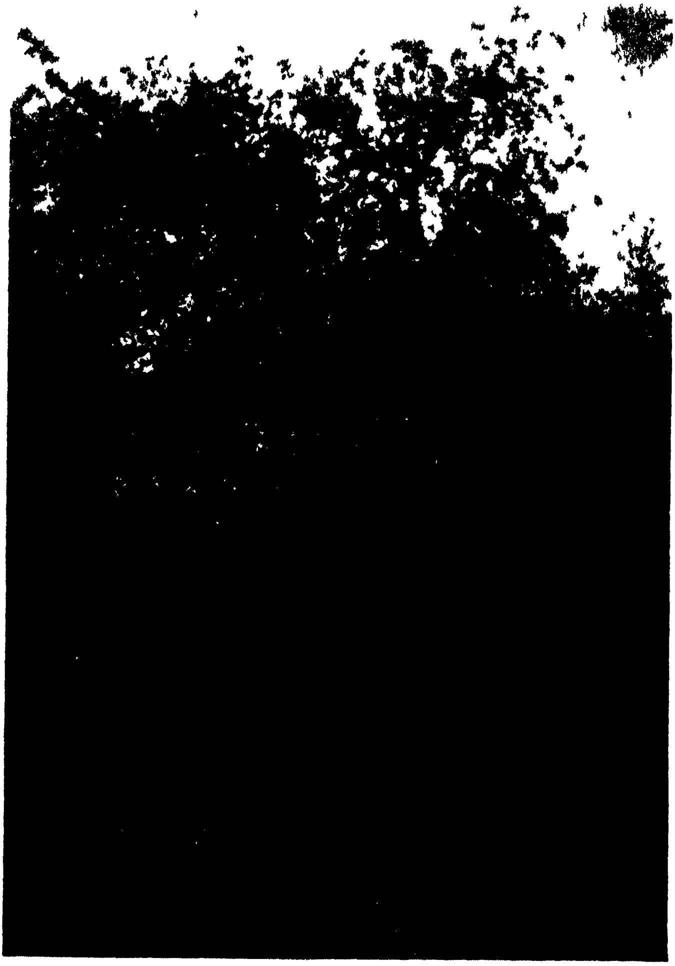


Fig. 42. A clump of scrub oak. Shows rocky nature of the substratum and the accumulation of leaf litter where so many of the crowded population of wintering birds foraged. Feeding conditions in this habitat are more favorable in the rainy winters than in the dry summers. Photograph taken April 19, 1929, at Inskip Hill. Mus. Vert. Zool. no. 5884.

good many medium-sized knob-cone pines, which are greener in mass appearance than the digger pines.

The scrub oaks predominating in this habitat formed dense thickets often ten feet in height and many yards in extent. The stiff and crooked branches intertwine so that the thicket is nearly impenetrable by a human being when walking erect. Close to the ground the branch-work is more open so that many times it is necessary, in order to make progress through a clump, for a person to get down on hands and knees. On the ground beneath the oaks is usually an accumulation of leaf litter, more marked than under most of the other kinds of shrubby plants in the section (fig. 42).

Of the mammals the two kinds we found living most characteristically in this type of vegetation were the Streator wood rat and the brush rabbit. Both these mammals, as well as others less frequently associated with them, were able to live through the year in this one habitat without being forced to modify to an appreciable extent their general modes of living in the different seasons.

The scrub oak chaparral, considered in the light of the needs of birds, differed radically from the green chaparral of higher altitudes in being suitable for occupancy in winter as well as in summer. Our records show that the scrub oak supported a decidedly larger bird population in winter even than in summer.

In winter the favorable influences for birds were chiefly ones having to do with food supply and concealment from the view of predators. The accumulated ground litter in winter was an especially favorable feeding place because it held a large amount of fruits and seeds from the plants which grew above and near-by; and probably, also, many insects passed the winter in quiescent stages in it. Then, too, the dense screen of evergreen foliage probably favored the ground beneath as a safe feeding place. Small brush-hunting hawks were numerous in the scrub oak covered areas, proof that many passerine birds wintered there and also that they were subject to dangers from this source.

Conditions for nesting in the scrub oaks were most favorable during April and early May, probably because of the greater supply of insect food in those months. By the end of May practically all the young birds were out of the nests. For the remainder of the summer this whole habitat was exceedingly dry and the activities of birds were at a minimum compared with any other part of the whole year. The most favorable nest sites in this habitat were those provided by the network of small twigs at heights varying from two to six feet from the ground. The resident species in the section most closely limited to the scrub oak habitat were the California thrasher, a ground forager, and the wren-tit, a low-foliage forager.

When the small size of the area covered by this type of brushy habitat is considered, the influence upon vertebrate animals becomes of manifest importance. The contrast is marked when comparison is made with the green chaparral of the higher mountains, which vegetationally is closely related to many of the plants associated with scrub oak. This serves to emphasize the necessity for weighing as many as possible of the factors effective in each part of the environment. It is the combination of circumstances rather than the predominance of any one particular factor which determines what assemblage of animals will live in any given place.

Fig. 43. Tall sage-brush on sandy soil in the eastern part of the section. Some of the clumps were over three meters high. This tree like type of shrub provides nesting situations for several kinds of birds not found where the bushes are smaller. Photograph taken October 17, 1924, at Box Springs. Mus. Vert. Zool. no. 4457.

Sage-brush.—The prevalent vegetation in a large portion of the eastern segment of the section was sage-brush. The westward extension of this type of vegetation was as far as Willow Creek Valley near the southern border of the section and to the vicinity of Poison Lake near the northern section border. Within this district sage-brush and plants of similar growth habit occupied most of the level ground, while on the slopes the bushes were interspersed with small trees.

Associated with the sage-brush and in some cases contributing importantly to the habitat were several other shrubby plants, more especially rabbit-brush and antelope brush. This type of ground cover varied from place to place, from scattered plants only a few inches high to tall tree-like clumps ten or twelve feet high, or to large, though lower, rounded bushes. In practically every case the clumps

Fig. 44. A clump of antelope brush (*Purshia tridentata*) in a sage-brush covered area. The fruits produced by this kind of plant are especially sought as food by many of the rodents occurring in the region. Photograph taken October 19, 1924, at Box Springs. Mus. Vert. Zool. no. 4454.

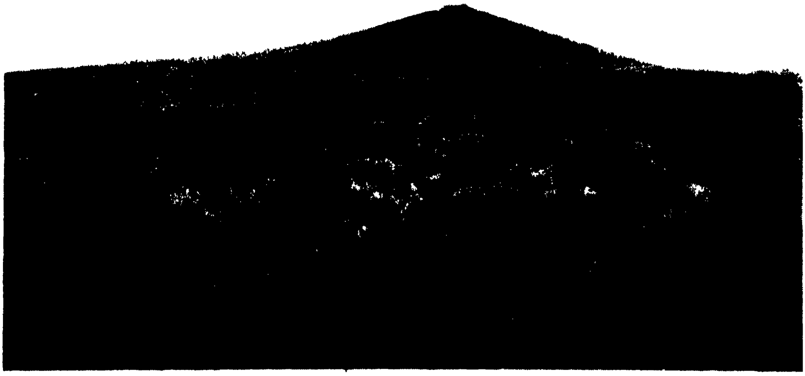


Fig. 45. A portion of the southern edge of Madeline Plains. Foreground shows stand of sage-brush inhabited by pigmy rabbits; in the center is a group of ranch buildings and accompanying planted trees, a typical non-native group of habitats in the eastern portion of the section; background shows Observation Peak from northwest side. Photograph taken October 16, 1924, at Dransfield's. Mus. Vert. Zool. no. 4447.

had spaces between them sufficient to allow a person to walk easily over the terrain (figs. 43 to 45).

Several factors present in this habitat are worthy of mention. With respect to food supply we observed that in at least one species, the sage hen, which was adapted to eat the leaves of the sage-brush, this proved to be the chief component of its food. The fruits of the antelope brush appeared to be especially sought as food by chipmunks.

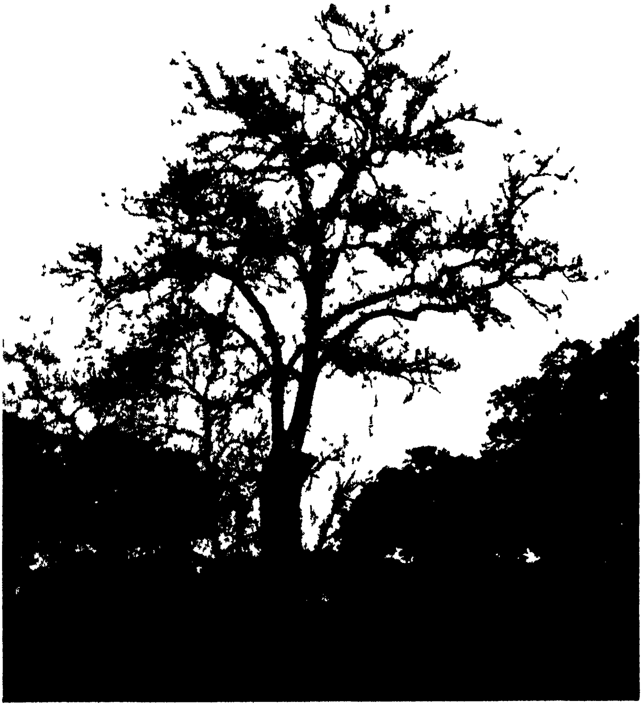


Fig. 46. Large sycamore near a stream in the Sacramento Valley. Shows two used nests of the yellow-billed magpie in characteristic surroundings. Photograph taken April 17, 1929, at Cone's. Mus. Vert. Zool. no. 5895.

Nest sites available in this habitat were largely the ones provided by crotches in the centers of those bushes which were of spindling form.

An important function of bushes in the sage-brush area was to furnish perches for birds which do not spend a large part of their time on the ground. Flycatchers, shrikes, and certain kinds of sparrows made use of these perches almost exclusively. Perches were used for singing stands, for lookouts from which to forage, and for resting places.

The strong winds so prevalent in the region result in many birds seeking shelter below the tops of the bushes. Also, many animals were dependent in summer upon the bushes for shade from the intense mid-day sunshine. Some other kinds of animals were restricted to those portions of the sage-brush area where the bushes were scattered and small. Here an important factor was evidently the openness of

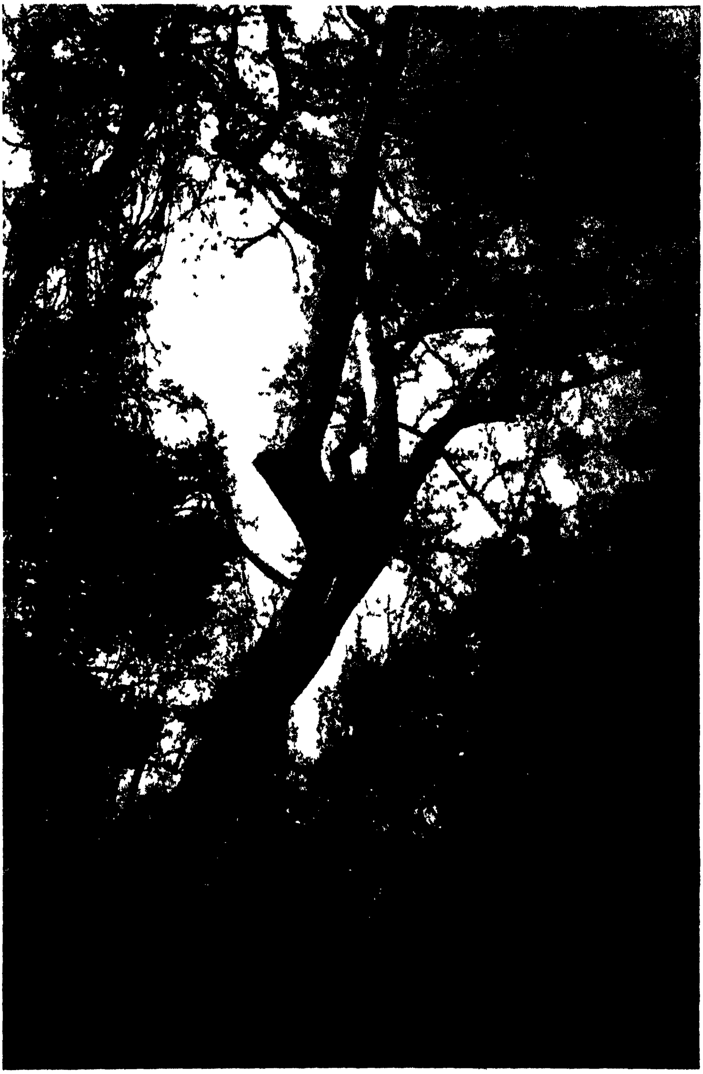


Fig. 47. Woodland of mixed kinds of broad-leafed trees and shrubs in bottomland close to Sacramento River. Shows entrance to cavity in sycamore, of a kind that was occupied by mammals such as the California coon (*Procyon lotor psora*). Photograph taken April 20, 1929, near Tehama. Mus. Vert. Zool. no. 5888.

the cover of bushes, permitting good visibility on the part of the animals living there. These animals often depend upon a quick get-away to escape approaching enemies. However, they were also dependent upon some sort of vegetation, even though small in amount, for carrying on other kinds of activity.

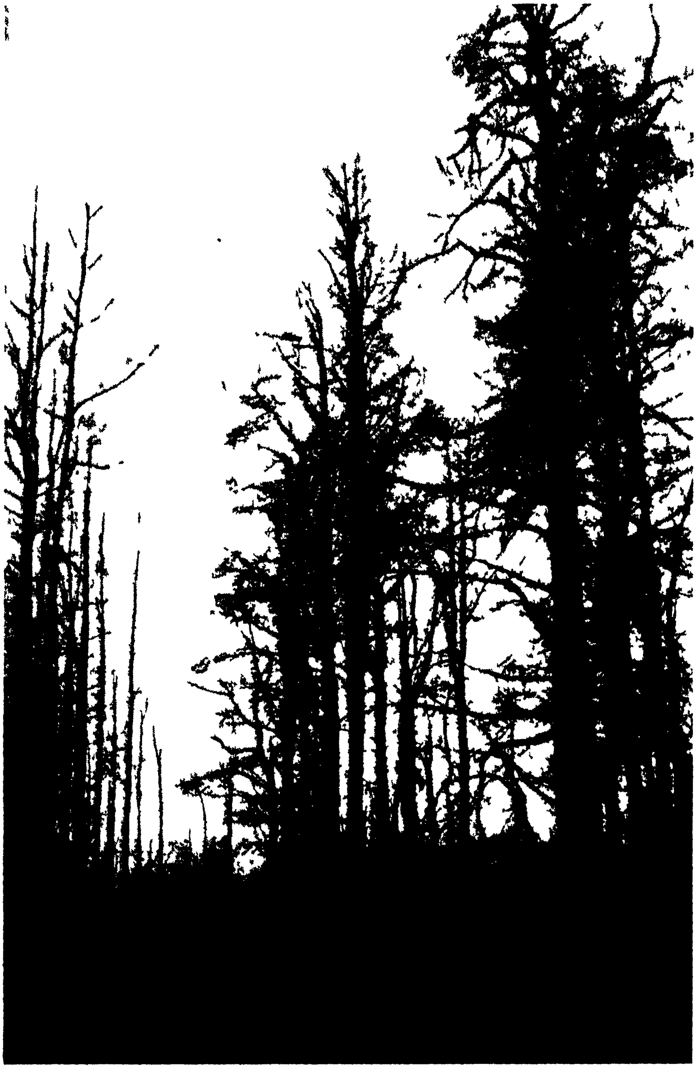


Fig. 48. Appearance in spring of groups of black cottonwoods and aspens as they occur at the borders of mountain meadows. Several kinds of birds seem to prefer to forage over these deciduous, broad-leafed trees rather than the closely adjacent coniferous trees. Photograph taken April 19, 1929, at Mineral. Mus. Vert. Zool. no. 5885.

The sage-brush area in the section brought in a large number of species whose presence was closely connected with this relatively uniform type of environment. The influences exercised by this habitat were more nearly integrated than those of any of the types of brushland habitat represented in the western end of the section.

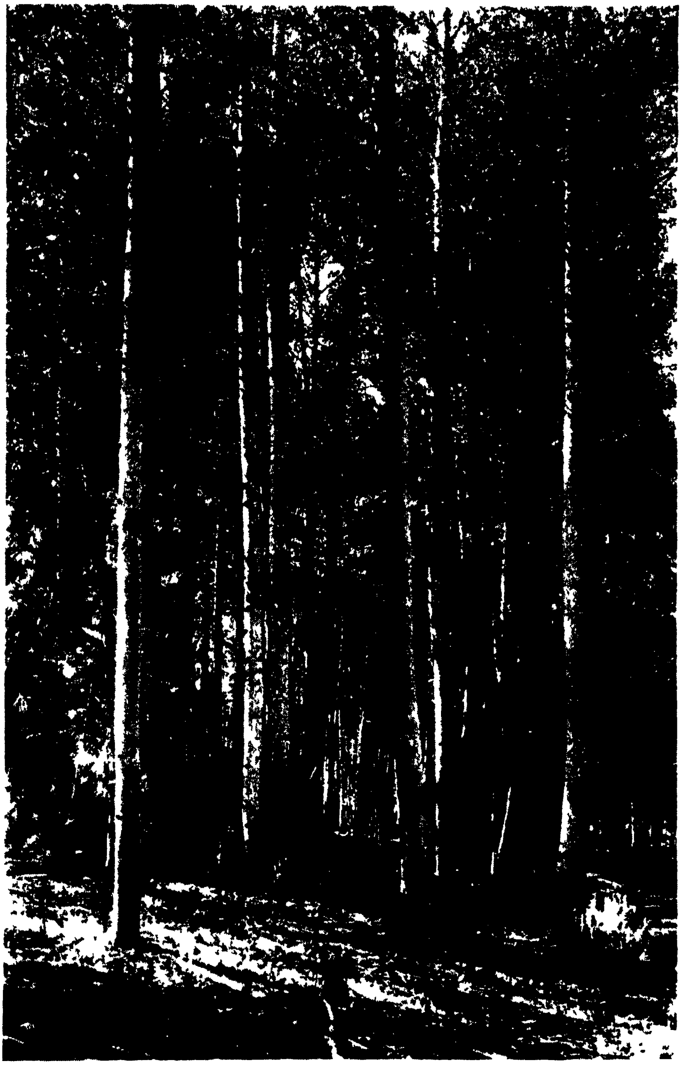


Fig. 49. Grove of aspens close to Pine Creek near its mouth at Eagle Lake. Shows ground litter beneath which moles tunneled. Photograph taken October 18, 1923. Mus. Vert. Zool. no. 4311.

WOODLAND HABITATS

Broad-leafed trees.—The deciduous trees bordering streams at many places throughout the section, and the trees of the open woodland in the western part of the section below the 3000-foot contour

Fig. 50. Grove of close-growing valley oaks on floor of the Sacramento Valley. The trees individually grew taller and less spreading here than when situated alone. Birds found here were ones nesting high above the ground or which lived on the trunks of the trees. Photograph taken April 17, 1929, at Cone's. Mus. Vert. Zool. no. 5890.

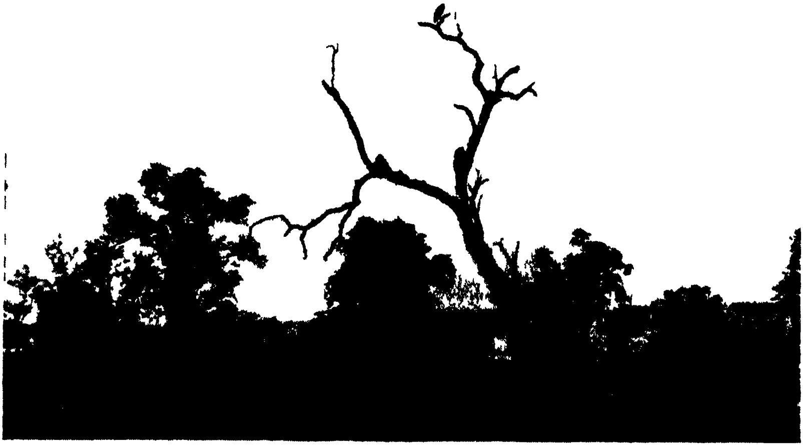


Fig. 51. Scattered stand of large valley oaks in cultivated field in Sacramento Valley. Nesting situations and perches provided by these trees attracted some species of birds different from the ones which inhabited the denser groves. Perching place of turkey vulture in foreground. Photograph taken April 17, 1929, at Cone's. Mus. Vert. Zool. no. 5891.

line, we are here discussing together under the term broad-leafed trees. The kinds of trees in this grouping which we found to be most attractive to birds and mammals in the section were the following: willow; cottonwood; aspen; sycamore; blue oak; valley oak; live oak.

Fig. 52. Live oak in ravine close to Sacramento River. The evergreen foliage of this tree was foraged over by birds assiduously in winter as well as in summer, and this fact may account for the winter residence of some insectivorous birds in the region. Photograph taken April 18, 1929, seven miles northeast of Red Bluff. Mus Vert. Zool. no. 5894.

The riparian trees along the Sacramento River and the lower courses of smaller streams are alder, cottonwood, ash, willow, and sycamore (figs. 46 and 47), with valley oaks closely adjacent. In many places this riparian strip is only 100 feet wide, even less. Near some of the intermittent streams the only trees are a few large isolated willows. At a few places in the eastern part of the section we saw more or less extensive groves purely of aspens (figs. 48 and 49).

Fig. 53. Broad-leafed trees in a ravine north of Red Bluff and west of the Sacramento River. The variety of conditions shown here provided suitable surroundings for a larger population of vertebrates than was found in most other parts of the woodland in the section. Photograph taken April 18, 1929, seven miles northeast of Red Bluff. Mus. Vert. Zool. no. 5887.

Of the broad-leafed trees the various kinds of oaks covered much more area in the section than all of the others put together. Southeast of Red Bluff many large valley oaks stood scattered over the flat valley floor, so many that the fairly distant horizon presented the appearance of an actual forest. Also, a few groves near the river were made up of tall trees of this species, growing so closely that their tops intermingled (figs. 50 and 51). In several of the cañons and ravines in the western part of the section, are clumps of the evergreen live oak (figs. 52 and 53).

Fig. 54. Stand of blue oaks on rolling hills west of Sacramento River. The nesting population of summer birds was greater here than on those areas where the trees were more scattered. Photograph taken April 18, 1929, eleven miles north of Red Bluff. Mus. Vert. Zool. no. 5889.

Fig. 55. Open stand of blue oaks such as covered much of the piedmont portion of the western slope of the section. This relatively uniform habitat attracted few species of vertebrates, and even of these, relatively few individuals. Photograph taken April 18, 1929, near Dale's. Mus. Vert. Zool. no. 5897.

Much of the area in the section north of Red Bluff and eastward of that place in the lower part of the piedmont region supports a typical stand of blue oak. The larger blue oaks are scattered, park-like (fig. 54), while the smaller ones grow in close clumps here and there. Usually the soil is hard-baked in summer, and there is but a scanty growth of annual vegetation. *The* plant of the piedmont country is the blue oak. It is astonishing how it thrives on this lava desert (fig. 55).

Fig. 56. Leaf litter beneath vines and broad-leafed trees close to Sacramento River. Many kinds of wintering birds foraged extensively in such protected situations as the one shown here. Photograph taken April 20, 1929, near Tehama. Mus. Vert. Zool. no. 5899.

Higher in the piedmont region the digger pine is a more conspicuous tree of the woodland than the blue oak. For present purposes we are classing this tree along with the broad-leafed ones, which predominate at lower altitudes.

The woodland trees affect in a variety of ways the food supply and feeding places of vertebrate animals, especially in the western part of the section. The trunks and twigs attract feeding birds in the same manner as the same type of tree does in other places. For foliage feeders it is worth noting that some of the trees, the live oaks, were evergreen and that they were depended upon for forage purposes perhaps more vitally in winter than in summer. Also, when an occasional snowfall did cover the valley, the dense crowns of these trees caught the snow and left patches of nearly bare ground beneath where ground feeders were then still able to forage. The most productive leaf litter for birds was produced beneath the valley oaks (fig. 56) and, on higher ground, the black oaks, in the western part of the section, and in the aspen groves in the eastern part.

Many of the larger trees on the lower ground in the section were heavily infested with mistletoe, which parasite grew in clumps bearing berries abundantly. These fruits in winter supplied food for great numbers of, in particular, gregarious kinds of birds, such as western bluebird, robin, and cedar waxwing. (See fig. 57.)

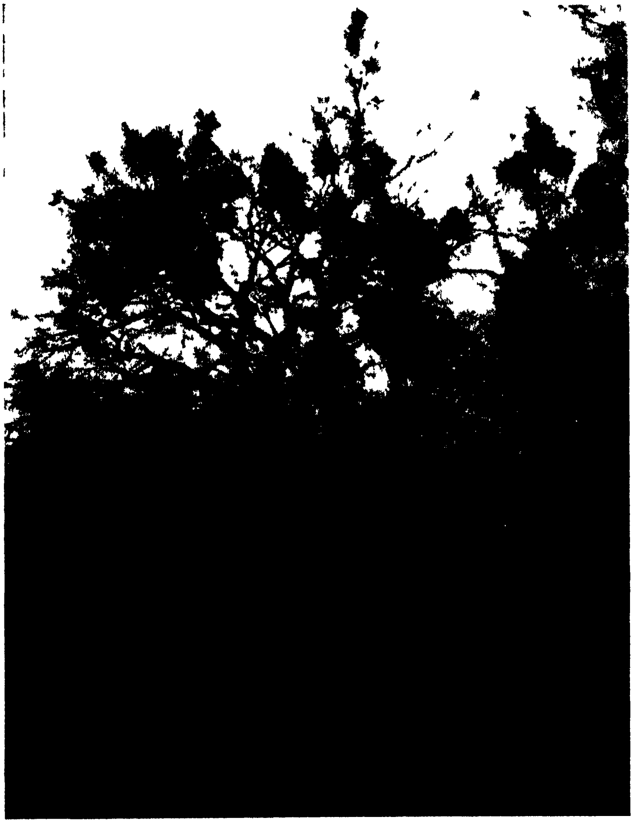


Fig. 57. Black oak in which are growing many clumps of mistletoe. Fruits of this parasitic plant provided sustenance in winter for many flocks of fruit-eating birds. Photograph taken April 19, 1929, at 3000 feet altitude on Lassen Highway. Mus. Vert. Zool. no. 5893.

The oaks provided an abundant food source in the acorns upon which several species were notably dependent. Our information shows the following species to be largely acorn feeders in this region: California jay; California woodpecker; wood duck; sandhill crane (winter only); gray squirrel. No species here was restricted entirely to this type of diet, and this is consistent with the fact of occasional failure of the acorn crop. Some other kinds of animals, such as the black bear, doubtless also fed on acorns when and where easily available.

In the spring as soon as the new leaves begin to grow, many birds, even some of the ordinarily ground foragers, spend much of their time feeding in the crowns of the trees. This was especially noted as regards the blue oaks and valley oaks.

On May 7, 1927, no birds could be found in leafless willows on Battle Creek Meadows, the same willows which were swarming with bird life when fully foliaged in June and July.

Fig. 58. Slope southwest of McDonald Peak. Shows normal scattered arrangement of junipers such as occurs generally on slopes in the eastern part of the section. Photograph taken October 12, 1924, from near Termo. Mus. Vert. Zool. no. 4446.

Close to Eagle Lake, October 18, 1923, it was noted that leaves of aspens were falling rapidly. There, a thick carpet of dead leaves was formed, beneath which burrows of moles were noted as especially numerous.

Another important type of influence exerted by this sort of habitat was provision of nesting situations. Aside from woodpeckers, the following species of birds in the section required cavities, such as were most often found in broad-leafed trees, for nesting: wood duck, screech owl, sparrow hawk, ash-throated flycatcher, tree swallow, violet-green swallow, purple martin, white-breasted nuthatch, plain titmouse, house wren, and western bluebird.

The form in which the blue oak grows in the section is especially adapted for furnishing nest-supporting crotches near the center of the tree. Observations made in the hills north of Red Bluff indicated that these sites were used by a good number of birds ranging in size from gnatcatchers to crows.

Singing perches and forage lookouts were provided by the tips of the trees, especially of the ones growing in open arrangements. In addition, several kinds of birds rested on perches within the screen of the crown foliage of trees in this habitat.

This habitat, although not quite so distinctive and so uniform in characteristics as some of the others represented in the section, proved to be one of the most stable from year to year. At any one particular place there has been comparatively little modification due to human interference. Doubtless this stable condition of affairs will remain for a very long time.

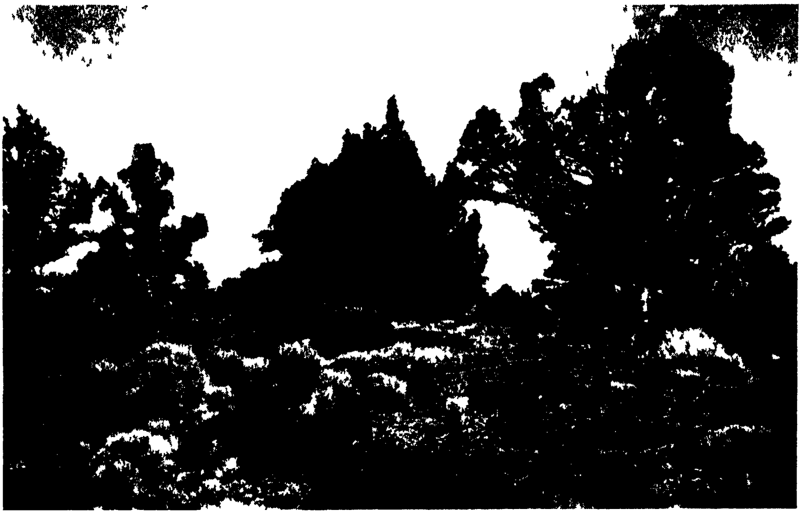


Fig. 59. Western junipers, the most important trees in the eastern part of the section. Shows growth-habit of this tree as well as a normal type of brush on the boulder strewn ground between the trees. Photograph taken October 12, 1924, near Termo. Mus. Vert. Zool. no. 4436.

Juniper.—Woodland, of a very open type in which juniper trees predominated, occupied almost all the sloping ground in the eastern part of the section westward as far as Eagle Lake. Although the junipers in the section were in nearly pure stands, these stands were so open as to leave expanses of bare or bush-covered ground between the trees (figs. 58 and 59). Sudworth's (1908, p. 181) general characterization of this tree applies to the form in which we found it in the section (fig. 168). In part, he says:

> . . . . Western juniper has a round-topped, open crown, extending to within a few feet of the ground, and a short, thick, conical trunk. Height, from 15 to 20 or, less commonly, 30 feet; . . . . diameter from 16 to 30 inches, exceptionally from 40 to 60 inches. The trunks, chunky and conical in general form, and with

ridges and grooves, are usually straight, even in the most exposed sites, but are sometimes bent and twisted. With its stocky form this tree develops enormously long and large roots which enable it to withstand unharmed the fierce winds common to its habitat. There is rarely more than from 4 to 8 feet of clear trunk, while huge lower branches often rise from the base and middle of the trunk like smaller trunks. . . . .

Fig. 60. Fruiting branch of western juniper. Certain species of birds and mammals come to these trees in the fall and feed extensively on these fruits. Photograph taken October 18, 1923, near Spalding's. Mus. Vert. Zool. no. 4309.

A distinctive group of bird species, of those living in the eastern part of the section, forages for insect food over the foliage of the junipers. The trees themselves provided food for birds in the form of fruits. These fruits ripened in late summer and were available thenceforth for some time both in the trees and on the ground immediately beneath them. Our observations made in October, 1923, disclosed a concentration of birds, especially robins and evening grosbeaks, around certain individual trees which that year bore heavy crops of berries. Some of these birds on being shot and examined proved to be exceptionally fat. Apparently, they had been living for several weeks on this easily obtained and rich food supply. (See fig. 60.)

The sturdy and solidly rooted trunks of the junipers stood erect usually long after the tree had aged and even after cavities had formed in the heartwood. As a result, nearly all the larger trees were hollow. These cavities, of varied shapes and sizes, were utilized for home sites by a surprisingly large number of birds and mammals. The bushy-tailed wood rat, for example, ordinarily living among rocks, in this habitat lived in the hollows of the trees and built stick nests on the basal portions of the large limbs near-by.

Fig. 61. An open stand of yellow pine on the west side of Eagle Lake. Shows relative absence of ground litter and shrubby undergrowth, as is usual in the forests of this region. Photograph taken October 25, 1923, near Spalding's. Mus. Vert. Zool. no. 4314.

FOREST LAND HABITATS

Coniferous trees.—The greater part of the higher terrain in the section from the 3000-foot contour line on the west eastward to the vicinity of Eagle Lake was covered by forest in which coniferous trees were most prominent. Although no figures bearing on the question are at hand it is estimated that close to one-third of the actual area of the section was, at the time of our observations in the region, clothed by coniferous forest of one type or another. (See figs. 61 to 70.)

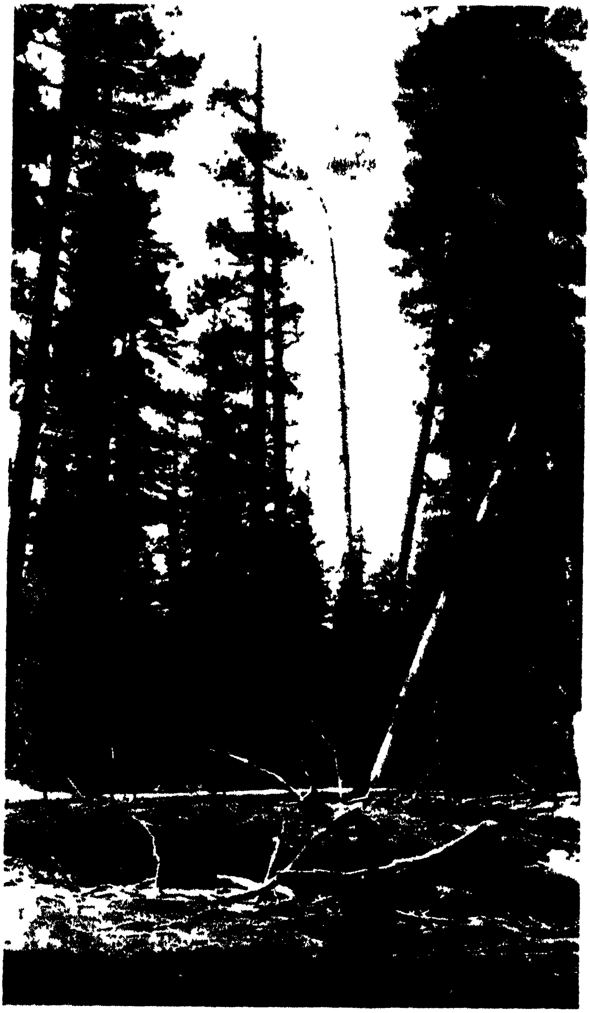


Fig. 62. A fallen log in close-growing yellow pine forest. When these forest trees fall, an opening is made in the forest which provides opportunity for new successions of habitats and consequent additions to the fauna of the vicinity. Photograph taken May 15, 1925, near Eagle Lake Resort. Mus. Vert. Zool. no. 4733.

The kinds of coniferous trees whose influence we judged to be most important for the activities of terrestrial vertebrates in the section were yellow pine, lodgepole pine, white fir, red fir, and hemlock. These trees, as well as others associated with them, varied in relative numbers from place to place. Also, they varied considerably in size and growth-form, and in many other features which have to do with the favorableness of the habitat for its vertebrate inhabitants. The food (seeds) produced directly by the trees differed in kind and availability with the differing species and in amount with differing locality and year.

In the lower portions of the forest, where the yellow pine is the most conspicuous tree, the growth is open and the ground is nearly bare. The larger trees ordinarily are far enough apart to prevent any one tree's being shaded by the others. Where the trees are younger they tend to grow closer together in clumps.

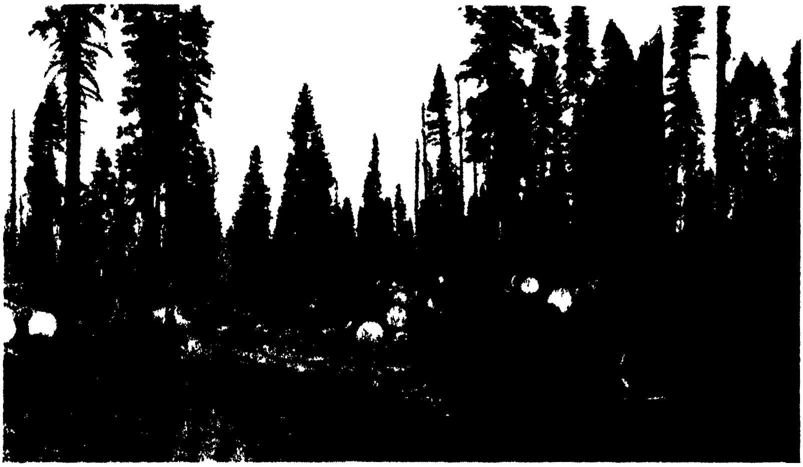


Fig. 63. A newly logged area in the yellow pine forest of the central part of the section. In foreground every tree has been cut; culls and young trees, white firs as well as yellow pines, in background, have been left by the timber cutters. Photograph taken September 22, 1924, near Westwood. Mus. Vert. Zool. no. 4461.

The higher forests, at altitudes between 6000 and 8000 feet, grew in closer stands than those on lower ground. There the moisture conditions in summer are more favorable for animal life on the forest floor than in the drier and more open yellow pine forest. Shrubby growths of chaparral plants occur irregularly in the forests up to about 7000 feet.

The lower limit of the forest in the section agrees fairly closely with the lower limit of the snow cover in the winter of average years. While, naturally, the greatest effect of the snow cover is upon the animals inhabiting the lowest stratum of the forest, some other more indirect effects were observed. Chief of these was the shape and position taken on by boughs of the trees, evidently as an adaptation in order to shed snow more readily. These flattened branches provided preferred supports for nests for one group of birds.

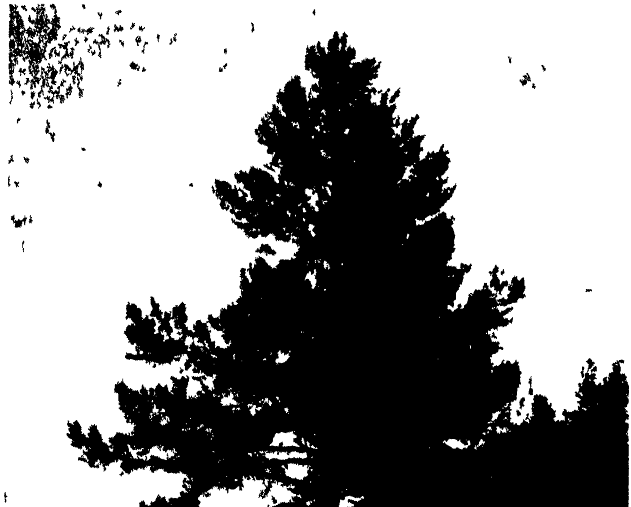


Fig. 64. Lodgepole pines at the edge of Battle Creek Meadows. Shows the long, slender horizontal limbs used by birds of a certain ecologic group for nesting supports. Photograph taken June 28, 1929. Mus. Vert. Zool. no. 5979.

The most conspicuous group of birds in the forest, the woodpeckers, nuthatches, chickadees, and creepers, was closely dependent upon the trees in respect to practically all their activities. Birds of this group tended to remain in the section, many of them in small restricted territories, throughout the year. Another rather well marked group of birds, less closely dependent on the trees themselves, comprised the insect feeding species whose food was obtained from the air between the tree tops or on the peripheral foliage and whose nests usually were saddled on limbs or boughs. Practically all this group of birds, consisting of warblers, flycatchers, and kinglets, moved out

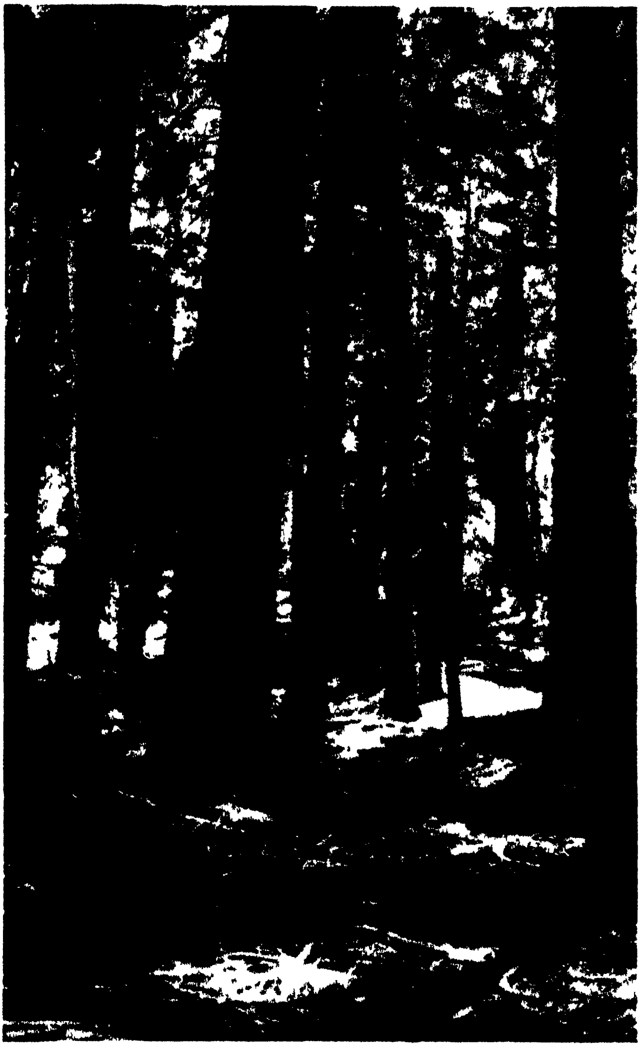


Fig. 65. Floor of coniferous forest; white fir predominating. Shows meager accumulation of ground litter and absence of herbaceous vegetation, although this is one of the most humid portions of the section. On this type of forest floor deer were seeking a certain fungus (see p. 567). Photograph taken June 28, 1929, near lower end of Battle Creek Meadows. Mus. Vert. Zool. no. 5971.

of the section, or at least out of the higher coniferous forest, for the winter period.

One distinct group of birds, the robins, nutcrackers, jays, and some of the finches, foraged largely on the ground but placed their nests in the trees. Winter conditions were met in various ways by these birds. Some modified their feeding habits slightly and remained in the same places through the year. Others invariably moved to lower altitudes for the cold season during which their usual forage places were covered with snow. Some other birds, as the crossbills and evening grosbeaks, apparently closely adapted to feed, especially in winter, upon the seeds produced by coniferous trees, were found at the places and at such times, irrespective of winter conditions otherwise, as crops of these seeds were borne in plenty.

Fig. 66. Group of lodgepole pines. Shows arrangement of trees and growth-form of this, one of the important plants in the coniferous forest for feeding companies of birds as well as for nesting activity. Photograph taken June 28, 1929, at lower end of Battle Creek Meadows. Mus. Vert. Zool. no. 5982.

The following observation bears on the question of the change in the forest habitat which accompanies the advance of spring. Near Mineral, on May 8, 1927, a consortium of small insectivorous birds was watched in a group of smallish white firs in which a ruby-crowned kinglet's nest had been found two years previously. These birds were insect gathering (in the afternoon) on the southwestern face of the foliage mass, the side away from the cold north wind as well as the side toward the warm afternoon sunshine. Furthermore, the firs stood on a gentle slope facing the south and from which the snow must have gone first. Thus spring, for fir-inhabiting insect life, must have been farthest along there. It was thought that such early-favorable conditions might possibly determine the location of nesting sites of such birds, at least, as the kinglets (fig. 67).

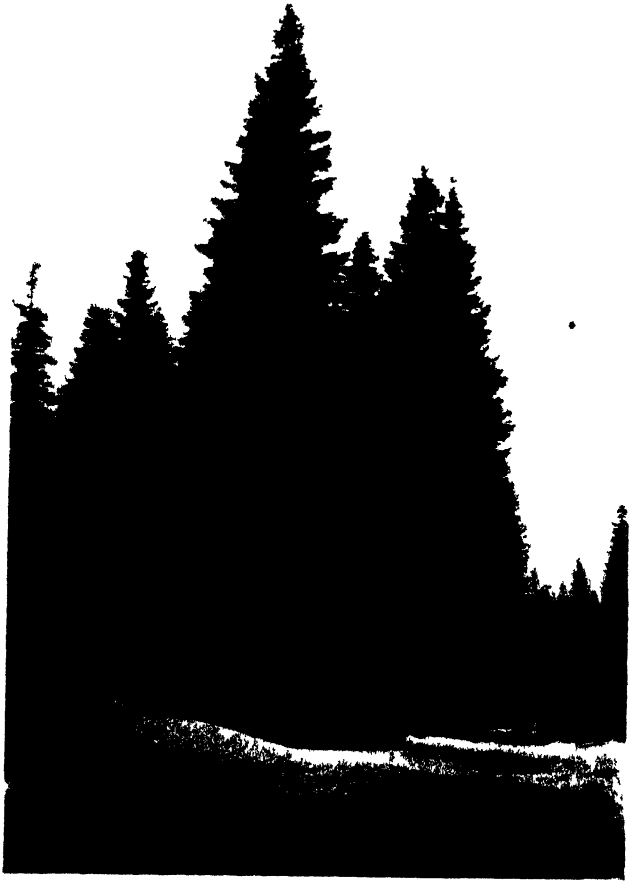


Fig. 67. Clump of medium-sized and young white firs on a south-facing gentle slope. Insect life in the foliage of these trees was conspicuously abundant and became active earlier in the season than at other situations in the neighborhood. Boughs like the ones shown here furnished foundations for nests for several kinds of birds. Photograph taken April 19, 1929, at Mineral. Mus. Vert. Zool. no. 5896.

Mammals in the forests of the section were either wholly ground-dwelling, like the red-backed mouse, or largely tree-dwelling. No opportunity was given in our work to seek out specific instances of the major kinds of interrelations between the forest and its mammalian inhabitants. To obtain significant results in this direction would require far more time and concentrated attention than we have been able to give to this group of habitats.

A circumstance which impressed itself upon us through repeated observations in the forest was that in the nearly mature forest of a closely uniform stand of large trees there were few conditions favoring the presence of vertebrate animals. Resulting from this, the animals were represented in such forests by scant populations both in number of species and number of individuals. This naturally leads to the general statement that as the lumber crop on any forested part of the section becomes larger the animal crop, as indicated by the number and variety of vertebrates present, will become smaller. Conversely, if mature trees be removed from the forest upon a judiciously selective basis then the crop of animal life will increase.

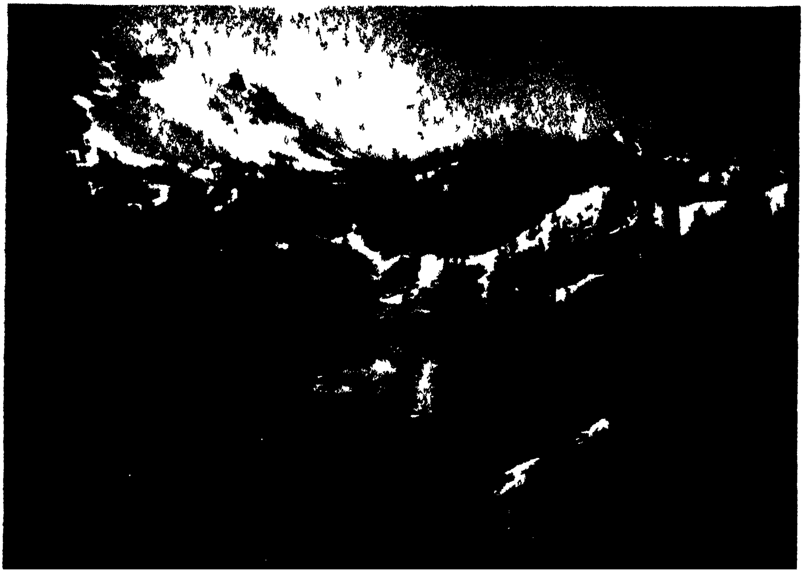


Fig. 68. Coniferous forest at the northwest base of Lassen Peak proper, toward Manzanita Lake. Upper edge of Canadian life zone in foreground, Hudsonian beyond. Photograph taken by B. F. Loomis.

This characteristic of the forest becomes manifest when observations are made in any of the areas where a close-growing stand of mature forest trees occurs. Wherever the uniformity of the forest has been broken by any sort of agency, then new surroundings have been made available to, and usually have been occupied promptly by, some additional kinds of animals (fig. 62).

The most extensive recent activity in timber cutting has taken place in the southern portion of the central part of the section. As shown in the accompanying photograph (see fig. 63) taken in that region, the changes in conditions that accompany logging are radical.

The quick removal of so many of the large trees on any given area is necessarily accompanied by changes in the animal life. Our work in the section indicated that a greater number of species and of individuals of the vertebrates occurred on the forested area subsequent to lumbering than occurred in mature stands of close-growing timber. This increased amount of animal life was noted at places where some trees had been left or where a period of years had elapsed after the clean cutting.

Fig. 69. View southeastward over the timbered area immediately east of Lassen Peak; Kelly Peak in center; Harkness Peak on left; valley of Warner Creek between. Shows red firs in foreground; also floor cover of pine-mat manzanita. Photograph taken by B. F. Loomis.

Stub-forest.—The band of trees on the southern and western sides of Eagle Lake which were killed by the latest upward fluctuation in the lake level make up what is here termed the stub-forest (figs. 71, 123, and 125). (See Brewster, 1924, pp. 17–19, for description of similar habitat in Maine.)

During a prolonged period of low water in Eagle Lake a belt of low ground one-quarter of a mile wide at the southwest end of the lake grew up to a stand of large yellow pines and white firs. Then, for a period of years the water level in the lake rose and these trees were killed. By 1921, when our earliest visit was made to this vicinity, the lake had lowered so that many of the dead trees stood some distance up the strand from the water. A number of these trees rotted near their bases and strong winds blew them over (fig. 149). In many of the others the tops and large limbs had rotted and these fell off. In many places there were mixtures of stumps and fallen logs and limbs.

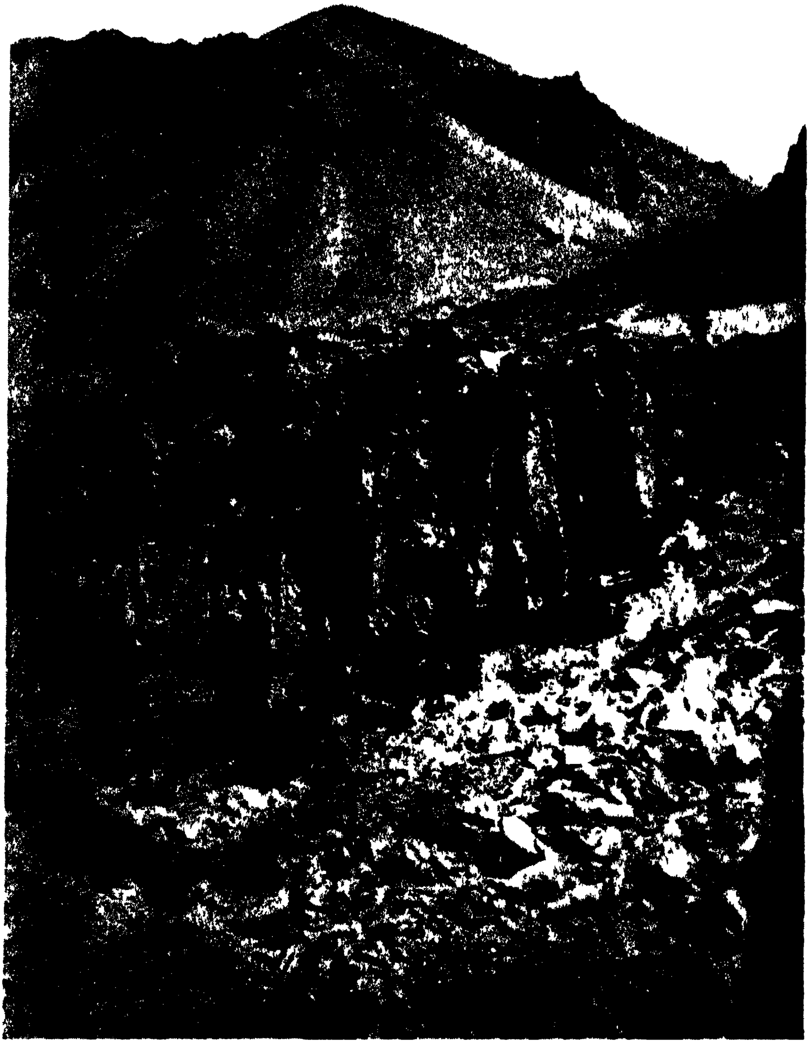


Fig. 70. Scattered type of forest at upper edge of tree belt; near-by, mountain hemlock, in distance, white-bark pine. Preponderance of talus slopes and cliffs leaves meager accommodations for tree growth. Photograph taken from near head of Manzanita Creek, by B. F. Loomis.

As regards the "stub-forest," there is no record of the time when it consisted entirely of living trees. That must have been before 1875, as that was the year of the lowest water within the period from that year to the present time. Graphs of lake levels elsewhere in the west show that the highest levels in their history were reached in 1867–68. However, it is probable that the belt of trees now constituting the stub-forest was drowned out within the past twenty-five years.

Practically the sole influence exerted upon the vertebrates by this habitat was through its provision of breeding situations. Because the stubs were located, with most of the birds, near to exceptionally favorable feeding grounds, they could support a large and varied population of nesting birds. Briefly, some of the situations and the kinds of birds occupying them were as follows: The larger limbs and broken-off tops formed bases for the nests of cormorants, ospreys, and bald eagles; large natural cavities were occupied by nesting ducks, American merganser and probably buffle-head; the softened trunks were drilled into by flickers and by Lewis, white-headed, and hairy woodpeckers; finally, the used nesting cavities of the woodpeckers were adopted and occupied by nuthatches, bluebirds of two species, house wrens, tree swallows, and chickadees.

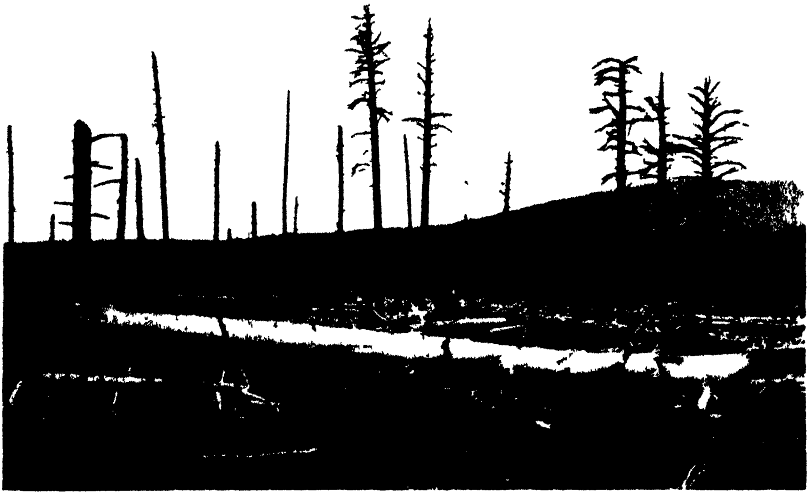


Fig. 71. Portion of the stub-forest on the western border of Eagle Lake. Shows a stage in which many trees have fallen, leaving the ground strewn with logs. Thus, the favorable nesting situations in this habitat remain for only a relatively few years. Photograph taken June 30, 1925. Mus. Vert. Zool. no. 4652.

Here is a clear case of a single factor, not at all a mensurable one, operating vitally to determine presence (versus absence) of at least some of the bird species just named.

Rock Land Habitats

Rocky-plain.—Representative rocky-plains were studied at two places in the section. A large part of the piedmont area east of the Sacramento Valley, from its edge to about the 1000-foot contour line, was of this type. Most of our time in this type of habitat was spent on the mesa on either side of Paine's Creek in the neighborhood of Dale's. The flat mesa to the eastward from Petes Valley in the eastern part of the section was also of this type of habitat.

Fig. 72. Plain near Dale's strewn with large blocks of lava. Many of the boulders sheltered feeding places and safety refuges of kangaroo rats and other small rodents. Trees in background are blue oaks. Photograph taken September 5, 1925. Mus. Vert. Zool. no. 4713.

Near Dale's the rocky-plain (figs. 72 and 73) was inhabited by colonies of kangaroo rats. These animals foraged for the seeds of the sparse vegetation and stored them in cavities beneath the rocks. A coyote was seen from time to time to jump to the tops of boulders, seemingly to get a better view of the surrounding terrain. Rocks were sufficiently conspicuous in these habitats to attract rock wrens. In the eastern part of the section, black-throated sparrows were seen on rocky-plains more often than in other habitats. Two species, antelope ground squirrel and leopard lizard, occurred on a rocky plain just outside the section near its eastern end, but we did not record them from within the limits.

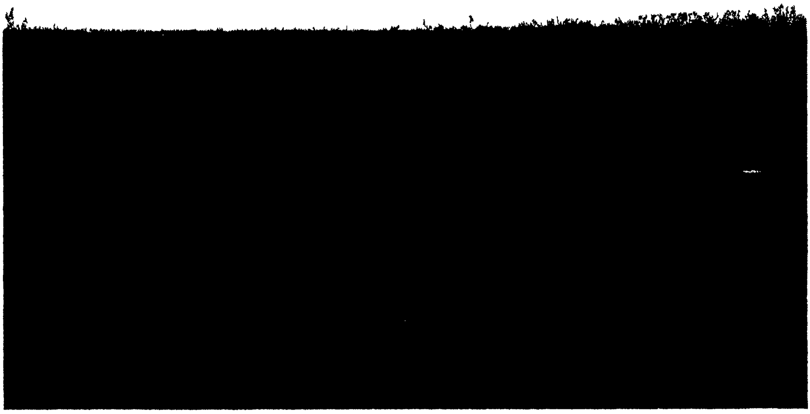


Fig. 73. Rocky plain on the lower part of the piedmont. Here the species of bird most numerous in summer was the ruddy horned lark (*Otocoris alpestris rubea*). Photograph taken April 18, 1929, two miles north of Dale's. Mus. Vert. Zool. no. 5898.

Fig. 74. Rock-slide of broken lava at the edge of Madeline Plains, three miles southwest of McDonald Peak. Conies (*Ochotona schisticeps taylori*) inhabited this accumulation of rocks. The ridge beyond is covered with sage-brush and junipers. Photograph taken October 12, 1924. Mus. Vert. Zool. no. 4439.

Rocky-slope.—All the kinds of steeply sloping ground where the surface is predominantly of rock have been grouped together for purposes of habitat discussion. Habitats of this type recur at short intervals over the whole section. They are most prominent on the cañon walls of stream courses and on the higher parts of mountains. (See figs. 74 to 78.)

At some places in the section erosional forces have left exposed, rock escarpments. These are most prominent near the tops of buttes and close to the rims of cañons. The weathered exposures of the more or less thick rock strata were broken and cracked, resulting in provision of places of retreat for a distinctive set of animal species. The factor of safety, through their being able to crawl into the crevices afforded in the belt of rock and boulders, seemed to be the chief

Fig. 75. Rock-slide on Warner Creek at 8000 feet, inhabited by conies and Sierra marmots. Shows plants suitable for the food of these mammals, growing among the rocks and at the edges of the slide. Photograph taken September 12, 1923. Mus. Vert. Zool. no. 4231.

one in attracting these animals to this type of environment. In practically every case foraging for food and for home-building materials had to be carried on away from the rocks. However, some of the insect-eating birds and lizards were able to obtain at least a part of their food from the rock surfaces and crannies.

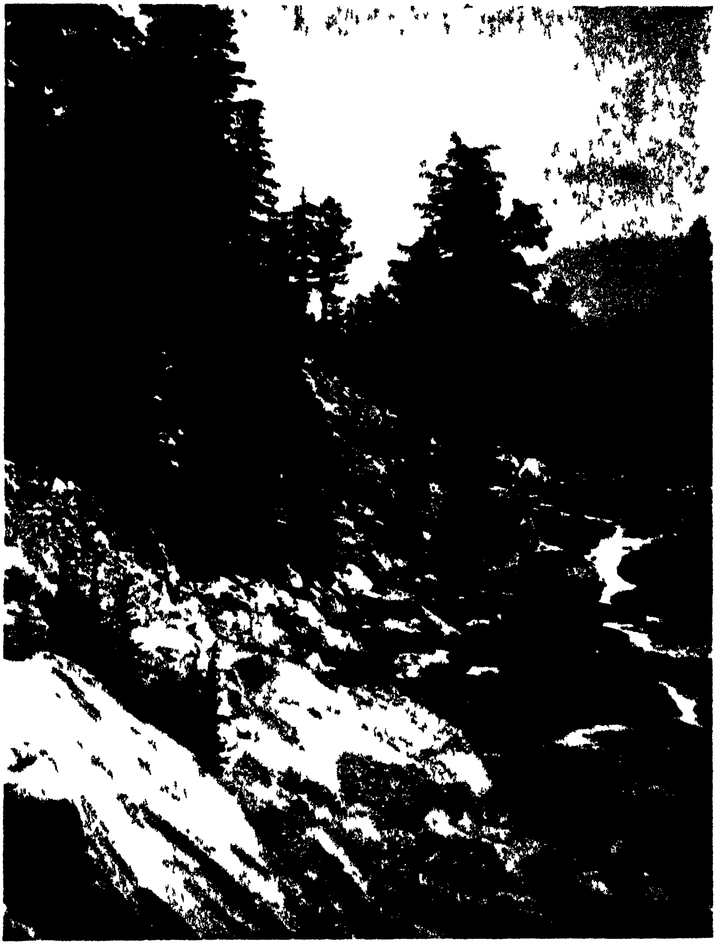


Fig. 76. Habitat of cony and bushy tailed wood rat in lower portion of talus slope on Warner Creek at 8300 feet Shows close by herbaceous vegetation which supplies food for the association of mammals which live among the rocks. The trees are mountain hemlock, life zone, Hudsonian. Photograph taken September 12, 1923. Mus. Vert Zool. no. 4227

Kinds of mammals and birds that were noted especially in this type of habitat were the following: wood rat, cottontail, porcupine, marmot, cañon wren, and rock wren

Fig. 77. Butte Lake. Shows recent flow of lava, around the landward edges of which several species of mammals found suitable homesites. Yellow pines in foreground. Photograph taken in 1928, by B. F. Loomis.

Fig. 78. Area of old broken lava at the southwestern side of Battle Creek Meadows. Here two conspicuous mammalian inhabitants were, side by side, gray-headed cony (*Ochotona schisticeps schisticeps*) and Douglas ground squirrel (*Otospermophilus douglasii*). Photograph taken June 28, 1929. Mus. Vert. Zool. no. 5976.

Higher in the mountains are many extensive areas of broken-up rocks which form steep talus slopes. Some flows of lava such as the one near Butte Lake present conditions nearly like the ones in the talus slope. In addition to furnishing protection in the many crannies, these broken rock areas are so situated that sedges and other vegetation grow at their edges. This provides an additional attraction for plant-feeding mammals. For example, conies inhabited the edges of the broken-rock masses where green plants were near, but

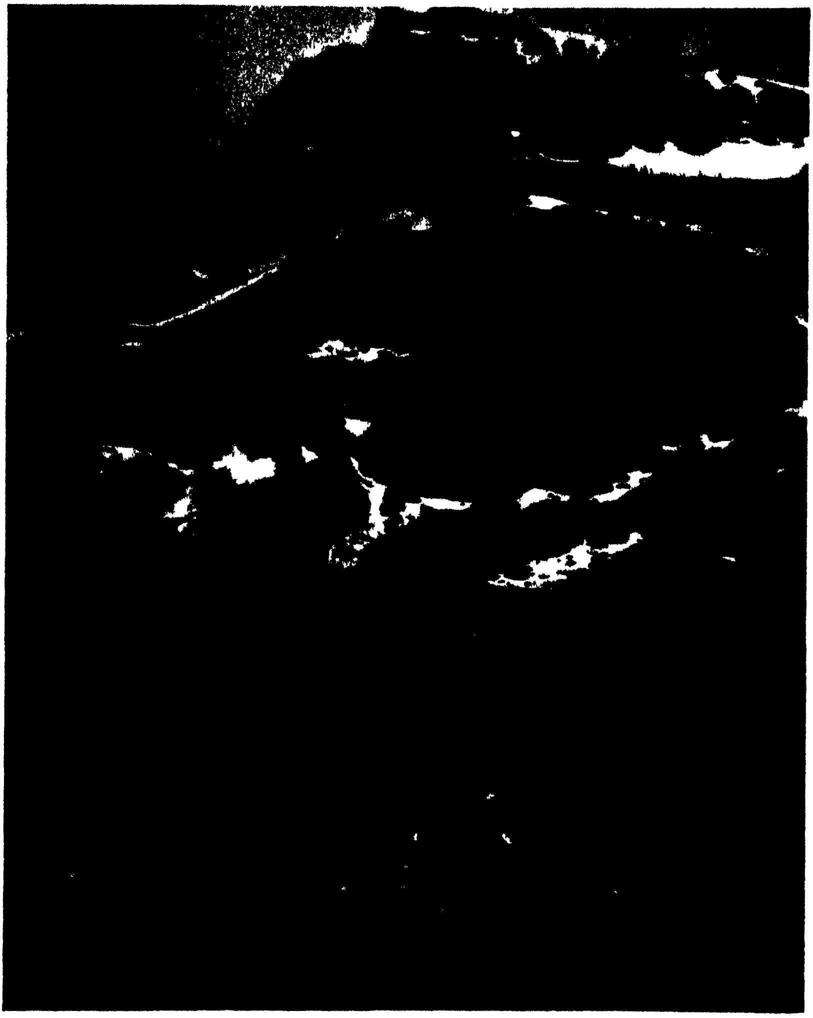


Fig. 79. Cliffs of north side of Broke-off Mountain around which duck hawks (*Falco peregrinus anatum*) were seen in flight. Photograph taken by B. F. Loomis.

they were absent from drier situations where plant food of this type was scanty or wanting. The large number of conies, in addition to the other small animals in these habitats, possibly accounted for an increased number of predatory species, such as the marten, in this habitat.

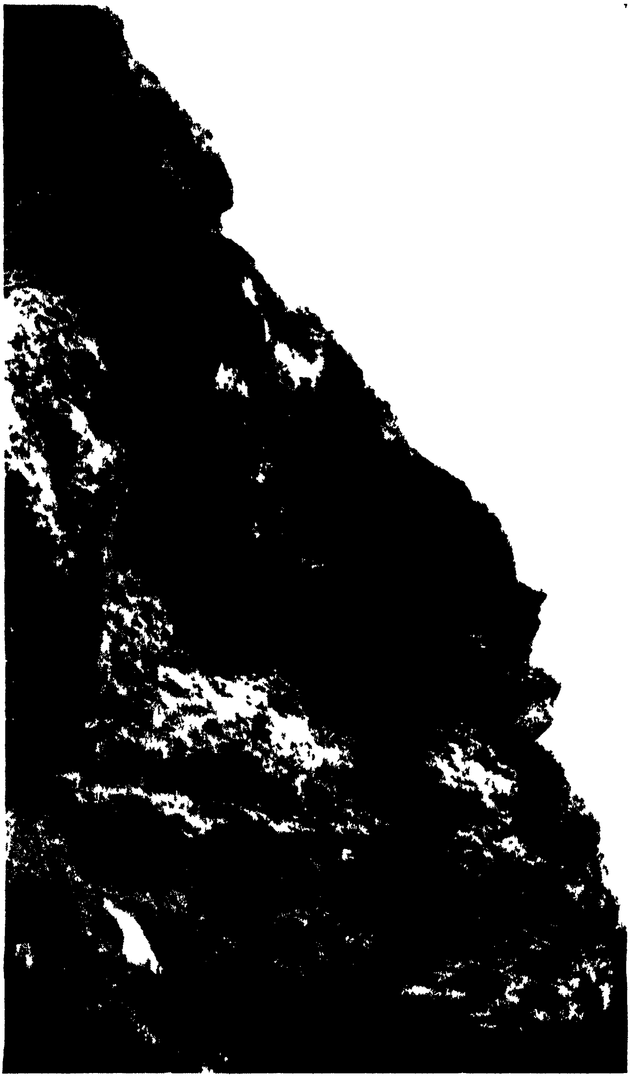


Fig. 80. Bank cut nearly vertically along Sacramento River. The small shelf near the center provided a nesting site for a pair of Pacific great horned owls (*Bubo virginianus pacificus*). Remains of nests of a colony of cliff swallows (*Petrochelidon albifrons albifrons*) show also. Evidences of occupation of this habitat by Streator wood rats (*Neotoma fuscipes streatori*) were noted. Photograph taken April 18, 1929, near Bend Ferry. Mus. Vert. Zool. no. 5864.

Another type of rocky habitat, the cliffs, was represented at but few localities in the section (fig. 79). Some cliffs were observed near the summits of the higher mountains and along the steeper sided cañons of the streams (fig. 80). Birds in the section which nested on the faces of cliffs were the duck hawk, prairie falcon, red-tailed hawk, and raven.

HUMAN-MADE HABITATS

Building.—Structures built by human beings in the section consist principally of houses and ranch buildings, and bridges. Groups of buildings, except in the immediate vicinity of the Sacramento River, are scattered. Red Bluff, Gerber, and Tehama, all west of the Sacramento River, are the only towns having more than a small group of buildings. Nearly half the places in the section where buildings or remains of buildings are found have been deserted because their human inhabitants could no longer draw a livelihood from the resources of the country.

The uses most often made of these structures by non-domestic animals were for activities connected with resting and with home sites. The following kinds of vertebrates were recorded in the section as making more than temporary use of buildings or bridges: bat (several species), wood rat (two species), white-footed mouse, great horned owl, barn owl, black phoebe, dipper, linnet, barn swallow, cliff swallow, and rock wren.

Road.—Not many roads have been built in the section outside of the few main highways. At many places the roads are ungraded, having been established only for temporary use, and these have introduced few new elements into the environment.

Most of the roadways in the western part of the section have borders of fence rows and lines of telephone poles, and these furnish perching places for birds which forage into the air or which watch the ground from established positions for movements of prey. The increased amount of vegetation protected from grazing at the sides of these roads also proved attractive for several kinds of birds.

On the hard-surfaced roads speeding automobiles provided a constant source of danger to the individuals of the species which frequented the roads or even crossed them occasionally. On nearly every trip over these roads we saw bodies of birds, mammals, or reptiles that had been run over and killed. In this manner an added supply of carrion food was made available for, and probably was used extensively by, meat feeders, especially night-prowling ones.

Some birds (sage hen, an example) went to the dry dirt roads to wallow in the dust there. In the mountains steep banks made in cutting roads provided nesting or foraging situations which were used by birds such as Townsend solitaire and rock wren.

The most important effect of roadways upon the fauna of the area was the indirect one of making it possible for men to reach easily all parts of the area. This has resulted usually in a reduction in the numbers of the large or conspicuous species that are hunted for food or for sport. But ordinarily the more common or smaller animals have not been affected appreciably.

Fig. 81. Cultivated field just after it had been worked over in spring. Several bird species, especially crows and yellow-billed magpies, foraged in numbers over the ground here. In winter the fields carried large crops of weeds the seeds of which attracted wintering birds in great numbers. Photograph taken April 17, 1929, at Cone's. Mus. Vert. Zool. no. 5892.

Cultivated field.—Cultivated fields in the western part of the section are limited to the soil of the Sacramento Valley floor (fig. 81) and to a few small cleared patches where water for irrigation is available near streams as high as Manton. In the eastern part of the section a few cultivated fields are made possible by careful conservation of the water from near-by ranges of hills.

Aside from truck patches most of the fields are planted to either alfalfa or grain (barley, oats, or rye). Most of the fields are small, and as cultivation is fairly intensive they are in summer unfavorable habitats for most kinds of vertebrates in the region. We saw evidence that crops in some fields were levied upon by jack rabbits, pocket gophers, and ground squirrels. A few birds foraged out into the edges of fields from favorable habitats at their borders.

In winter in cases where the fields had been left unplowed, abundant crops of weed seeds ripened. Among the plants contributing to this supply were pigweed and star thistle, both prolific seed bearers. Flocks of winter-visitant finches gathered to subsist on this easily obtained food. All the plants contributing in large amount to this food source were introduced species of weeds. No other type of habitat (native vegetation) in the region produced such large amounts for comparable units of area of this kind of food. The numbers of wintering birds of the species concerned were much smaller in the habitats in which native vegetation predominated than in these fields of comparatively recent establishment.

The conditions outlined above are not peculiar to the Lassen section, as a comparable situation is found over a large part of the country. It seems not unreasonable to suppose that this provision of such a favorable food source, that is taken advantage of by so many birds, makes it possible for a much larger population of the species concerned, to live. It is possible that, with this type of bird, success in finding suitable winter forage has more to do with actual population size than the success in carrying out activities concerned with the other seasons.

Orchard.—A considerable part of the Sacramento Valley land has been set out in orchards. Also we observed a few orchards in the vicinity of Manton. Almost all the orchards were made up of small, well pruned trees. The successful ones were regularly irrigated, sprayed, and cultivated in order to insure fruit production of amount and quality to market.

Ripening cherries in orchards near Manton in June attracted feeding birds of several species from the surrounding land. These birds were sufficiently numerous to cause concern to the orchardists. Although we did not check by actual observation, we were told that the almond crop at Elliott's was damaged considerably each year by California woodpeckers.

The bushy topped trees in orchards proved particularly attractive to some birds. For example, our only record for the mockingbird in the western part of the section was of one seen in an orchard.

LIFE-ZONES OF THE LASSEN SECTION

Since the general acceptance on the part of field workers in vertebrate zoology of the concept of life-zones in North America as proposed by C. Hart Merriam, progress in this subject has consisted largely in (1) determining what plants and animals might best be considered indicators of the several zones, and (2) determining the limits of, and mapping, the zones themselves. In most of the work of mapping the zones chief reliance has been placed on the occurrence of conspicuous plant species for determining the limits of each life-zone. (See Hall and Grinnell, 1919.)

The accompanying map (fig. 2) showing the position and extent of each of the life-zones represented in the Lassen section has resulted from our observation and record of the occurrences of a certain few trees and prominent shrubs considered to be satisfactorily characteristic. These selected plant indicators, only the ones used most dependably by us in determining zonal positions of localities in the Lassen section, are as follows:

Lower Sonoran

- **Populus fremontii**
- **Quercus lobata**

Upper Sonoran

(Slopes of Sacramento Valley)

- **Pinus sabiniana**
- **Quercus douglasii**
- **Quercus wislizenii**
- **Cercis occidentalis**
- **Aesculus californica**
- **Ceanothus cuneatus**
- **Arctostaphylos viscida**
- **Arctostaphylos manzanita**
- **Eriodictyon californicum**

(Great Basin)

- **Juniperus occidentalis (in main stand)**
- **Ribes velutinum**
- **Cercocarpus ledifolius**
- **Purshia tridentata**
- **Chrysothamnus nauseosus (in full vigor)**
- **Artemisia tridentata (in full vigor)**

Transition

- **Pinus ponderosa**
- **Pinus lambertiana**
- **Libocedrus decurrens**
- **Abies concolor**
- **Quercus kelloggii**
- **Ceanothus integerrimus**
- **Ceanothus prostratus**
- **Cornus nuttallii**
- **Rhododendron occidentale**

Canadian

- **Pinus monticola**
- **Pinus ponderosa, var. jeffreyi**
- **Abies magnifica**
- **Quercus vaccinifolia**
- **Castanopsis sempervirens**
- **Ceanothus velutinus (massed occurrence)**
- **Ceanothus cordulatus (massed occurrence)**
- **Ledum glandulosum**
- **Arctostaphylos patula (massed occurrence)**

Hudsonian

Pinus albicaulis	Phyllodoce breweri
Tsuga mertensiana	Arctostaphylos nevadensis

Arctic-Alpine

[None used by us, though certain herbaceous plants have been found by botanists on Lassen Peak which fall definitely, on basis of their distribution at large, into the Arctic-Alpine category.]

The usual precautions were observed in evaluating the significance of plant indicators for mapping purposes. The local occurrence of a given species in other than optimum growth form or in other than normal population numbers was not considered alone to warrant reliance upon it for the zonal position of that place. For example, the sparse and much dwarfed representation of antelope brush (*Purshia tridentata*) on the upper slopes of Prospect Peak was not considered as establishing the presence of Upper Sonoran there, even in dilute phase, especially when surrounded by normally growing red firs, silver pines and Jeffrey pines, these being indicative of the Canadian life-zone. And, in the other direction zonally, a group of small yellow pines on a ravine-side surrounded by dominantly Upper Sonoran chaparral did not warrant marking a spot of Transition upon our map, especially in view of the small scale of the topographic maps used as bases.

We wish here to make acknowledgment to Mr. A. E. Wieslander, of the California Forest Experiment Station, United States Forest Service, for the privilege of examining the map of forest types in California now being prepared by him. The ranges of certain trees as indicated on that map have been used by us in checking, and in some places modifying, the limits of the life-zones as shown on our map.

The breadth of the belts of overlapping of adjacent life-zones varied, of course, with declivity, slope exposure, and moisture conditions, so that the placing of a *line* of zonal demarcation upon a map had to depend upon the subjective weighting of observations gradually accumulated and covering a considerable extent of country. First impressions frequently were not found to accord with the final determinations. Especially in the eastern end of the section difficulties in this regard were encountered, for in places there, as is well known of similarly situated regions (foı example, see Grinnell and Storer, 1924, pp. 8–10), conditions of aridity and high base level produce a confusing admixture of life-zone indicators.

We now present lists of the terrestrial vertebrates of the Lassen section for each of the life-zones represented there. With birds and some mammals which migrate, or at least whose populations move about to greater or less extent seasonally, it is understood that the zonal position is that of the breeding range. And in all species it is understood that the metropolis or main center of population is concerned; for by reason of the continual process of pioneering, occasional pairs of any species whose individuals are capable of rather free locomotion are likely to be found established for breeding, one year or another, far outside the normal life-zone of their kind. The finding of one or more Brewer sparrows at Manzanita Lake in 1926 does not warrant ranking that typically Upper Sonoran species as belonging also to the Canadian!

The following lists do not contain the names of transient or winter-visitant species of birds, nor the names of any animals included in our complete list under General Accounts, concerning the nature of whose occurrence in the Lassen section our knowledge is so meager as to make any conclusion as to their zonal status unwarranted. At the same time we have permitted ourselves some latitude of assumption, even where only one or a few definite record stations are available, when general knowledge confirms the zonal diagnosis indicated.

Species and subspecies found by us chiefly or only in Lower Sonoran:

Bufo boreas halophilus
Cnemidophorus tesselatus mundus
Lampropeltis getulus boylii
Contia tenuis
Thamnophis ordinoides atratus
Aix sponsa
Buteo lineatus elegans
Chordeiles acutipennis texensis
Otocoris alpestris rubea
Pica nuttallii
Vireo bellii pusillus
Agelaius phoeniceus californicus
Guiraca caerulea salicarius
Scapanus latimanus latimanus
Pipistrellus hesperus merriami
Thomomys bottae navus
Sylvilagus audubonii audubonii

Species found by us chiefly or only in both Lower and Upper Sonoran:

Sceloporus occidentalis occidentalis
Gerrhonotus scincicauda scincicauda
Coluber constrictor mormon
Pituophis catenifer heermanni
Clemmys marmorata
Lophortyx californica vallicola
Zenaidura macroura marginella
Geococcyx californianus
Tyto alba pratincola
Otus asio quercinus
Speotyto cunicularia hypugaea
Balanosphyra formicivora bairdi
Dryobates pubescens turati
Dryobates nuttallii
Tyrannus verticalis
Myiarchus cinerascens cinerascens
Sayornis nigricans semiatra
Stelgidopteryx ruficollis serripennis
Hirundo rustica erythrogaster
Aphelocoma californica immanis
Corvus brachyrhynchos hesperis
Baeolophus inornatus inornatus
Psaltriparus minimus californicus
Sitta carolinensis aculeata

Thryomanes bewickii drymoecus
Lanius ludovicianus gambeli
Icteria virens longicauda
Icterus bullockii
Passer domesticus domesticus
Carpodacus mexicanus frontalis
Spinus tristis salicamans
Spinus psaltria hesperophilus
Pipilo maculatus falcinellus
Pipilo fuscus carolae
Chondestes grammacus strigatus
Tadarida mexicana
Mus musculus

Species found chiefly or only in Upper Sonoran:

Triturus torosus
Scaphiopus hammondii
Rana aurora draytonii
Uta stansburiana stansburiana
Coluber lateralis
Pituophis catenifer deserticola
Thamnophis ordinoides couchii
Querquedula cyanoptera
Centrocercus urophasianus
Catoptrophorus semipalmatus inornatus
Bubo virginianus occidentalis
Phalaenoptilus nuttallii californicus
Archilochus alexandri
Calypte anna
Empidonax griseus
Empidonax difficilis difficilis
Pica pica hudsonia
Corvus corax sinuatus
Baeolophus inornatus griseus
Psaltriparus minimus plumbeus
Chamaea fasciata henshawi
Catherpes mexicanus punctulatus
Catherpes mexicanus conspersus
Toxostoma redivivum sonomae
Oroscoptes montanus
Polioptila caerulea amoenissima
Pooecetes gramineus confinis
Amphispiza belli nevadensis
Amphispiza bilineata deserticola
Spizella breweri
Myotis yumanensis sociabilis
Myotis subulatus melanorhinus
Bassariscus astutus raptor
Spilogale phenax phenax
Urocyon cinereoargenteus californicus
Sciurus griseus griseus
Perognathus parvus mollipilosus
Dipodomys heermanni californicus
Dipodomys heermanni saxatilis
Dipodomys ordii columbianus
Microdipodops megacephalus oregonus
Onychomys leucogaster fuscogriseus
Reithrodontomys megalotis megalotis
Peromyscus crinitus crinitus
Peromyscus truei truei
Neotoma intermedia nevadensis
Ochotona schisticeps taylori (one record)
Lepus californicus wallawalla
Sylvilagus bachmani bachmani
Sylvilagus idahoensis
Odocoileus virginianus macrourus
Ovis canadensis californiana

Species found in Lower and Upper Sonoran and Transition:

Rana boylii boylii
Thamnophis sirtalis infernalis
Ardea herodias hyperonca
Anas platyrhynchos platyrhynchos
Cathartes aura septentrionalis
Buteo borealis calurus
Falco sparverius phalaena
Oxyechus vociferus vociferus
Bubo virginianus pacificus
Megaceryle alcyon caurina
Petrochelidon albifrons albifrons
Progne subis subis
Troglodytes aëdon parkmanii
Geothlypis trichas occidentalis
Sturnella neglecta
Passerina amoena
Mustela vison energumenos
Lutra canadensis brevipilosus
Mephitis occidentalis occidentalis
Lynx rufus californicus
Otospermophilus douglasii
Reithrodontomys megalotis longicaudus
Peromyscus boylii boylii
Peromyscus truei gilberti
Neotoma fuscipes streatori
Microtus californicus eximius
Lepus californicus californicus

Species found in Lower and Upper Sonoran, Transition and Canadian:

Iridoprocne bicolor
Hylocichla ustulata ustulata
Dendroica aestiva brewsteri
Euphagus cyanocephalus minusculus
Passerella melodia mailliardi
Eptesicus fuscus fuscus
Taxidea taxus neglecta

Species found by us in all the life-zones, Lower Sonoran to Hudsonian:

Hyla regilla
Actitis macularia
Colaptes cafer collaris
Procyon lotor psora
Canis lestes [or, and, C. ochropus]
Peromyscus maniculatus gambelii

Species found chiefly or only in Upper Sonoran and Transition:

Thamnophis ordinoides elegans
Crotalus oreganus
Colymbus nigricollis californicus
Aechmophorus occidentalis
Pelecanus erythrorhynchos
Phalacrocorax auritus albociliatus
Mergus americanus
Buteo swainsoni
Aquila chrysaëtos
Pandion haliaëtus carolinensis
Steganopus tricolor
Larus californicus
Sterna forsteri
Chlidonias nigra surinamensis
Otocoris alpestris merrilli
Tachycineta thalassina lepida
Telmatodytes palustris plesius
Sialia mexicana occidentalis
Dendroica nigrescens
Xanthocephalus xanthocephalus
Zamelodia melanocephala capitalis
Passerculus sandwichensis nevadensis
Passerella melodia fisherella
Mephitis occidentalis major
Lynx rufus pallescens
Eutamias minimus pictus
Thomomys bottae leucodon
Thomomys quadratus quadratus
Microtus mordax mordax
Ondatra zibethica mergens
Lepus townsendii townsendii
Sylvilagus nuttallii nuttallii
Antilocapra americana americana

Species found in Upper Sonoran, Transition, and Canadian:

Sceloporus graciosus gracilis
Branta canadensis canadensis
Rallus virginianus pacificus
Capella delicata
Chordeiles minor hesperis
Empidonax traillii brewsteri
Myiochanes virens richardsonii
Salpinctes obsoletus obsoletus
Turdus migratorius propinquus
Sialia currucoides
Vireo solitarius cassinii
Vireo gilvus swainsonii
Vermivora celata lutescens
Agelaius phoeniceus nevadensis
Oberholseria chlorura
Spizella passerina stridula
Scapanus latimanus dilatus
Myotis californicus californicus
Mustela arizonensis
Marmota flaviventer flaviventer
Citellus oregonus
Neotoma cinerea occidentalis
Microtus montanus yosemite
Erethizon epixanthum epixanthum
Odocoileus hemionus hemionus

Species found chiefly or only in Transition:

Ensatina sierrae
Eumeces skiltonianus
Podilymbus podiceps podiceps
Accipiter velox
Haliaeëtus leucocephalus leucocephalus
Asyndesmus lewisi
Sitta pygmaea pygmaea
Vermivora ruficapilla gutturalis
Carpodacus purpureus californicus
Lasionycteris noctivagans
Felis oregonensis californica

Species found both in Transition and Canadian:

Bufo boreas boreas
Gerrhonotus palmeri
Gavia immer
Charitonetta albeola
Astur atricapillus
Dendragapus obscurus sierrae
Oreortyx picta picta
Stellula calliope
Ceophloeus pileatus picinus
Sphyrapicus varius daggetti
Sphyrapicus thyroideus thyroideus (but metropolis in Canadian)
Dryobates villosus orius
Xenopicus albolarvatus albolarvatus
Empidonax hammondii
Empidonax wrightii
Nuttallornis mesoleucus majorinus
Cyanocitta stelleri frontalis
Sitta carolinensis nelsoni
Certhia familiaris zelotes
Hylocichla guttata sequoiensis
Regulus satrapa olivaceus
Corthylio calendula cineraceus
Dendroica occidentalis
Oporornis tolmiei (metropolis in Transition)
Wilsonia pusilla chryseola
Piranga ludoviciana
Hesperiphona vespertina brooksi
Spinus pinus pinus
Passerella lincolnii lincolnii
Passerella iliaca fulva
Passerella iliaca mariposae
Neürotrichus gibbsii gibbsii
Sorex trowbridgii mariposae
Myotis lucifugus carissima
Myotis evotis chrysonotus
Ursus americanus californiensis
Martes caurina sierrae
Vulpes fulva necator
Eutamias senex
Sciurus douglasii albolimbatus
Glaucomys sabrinus lascivus
Microtus mordax sierrae
Aplodontia rufa californica
Zapus pacificus alleni
Lepus washingtonii klamathensis
Odocoileus columbianus columbianus

Species found in Transition, Canadian, and Hudsonian:

Rana pretiosa pretiosa
Penthestes gambeli abbreviatus (also in Upper Sonoran easterly)
Sitta canadensis
Cinclus mexicanus unicolor
Myadestes townsendi
Dendroica auduboni auduboni
Carpodacus cassinii
Loxia curvirostra bendirei
Junco oreganus thurberi
Sorex vagrans amoenus
Sorex palustris navigator
Callospermophilus chrysodeirus chrysodeirus
Eutamias amoenus amoenus
Eutamias speciosus frater
Thomomys monticola monticola
Ochotona schisticeps schisticeps

Species found chiefly or only in Canadian:

Glaucionetta islandica
Mustela muricus
Evotomys mazama

Species found in Canadian and Hudsonian:

Picoides arcticus
Nucifraga columbiana

With the above lists of species and the accompanying zone map (fig. 2) before us, certain comments can be made as to nature of limitations and general significance. Our formal recognition of the Lower Sonoran life-zone in the Sacramento River valley might well be questioned on the ground that the zonal position of the *majority* of the species occupying the same territory (orange on the map) as the Lower Sonoran species which we list, is, farther south in California where the Austral zones are developed in full measure, Upper Sonoran. Also a few of our Lower Sonoran species, so designated, are known elsewhere to invade Upper Sonoran. There are left, as present within the Lassen section, only a meager group of species which, in the Pacific Coast states, are sharply distinctive of Lower Sonoran as this zone is better developed to the southward, namely, *Cnemidophorus tesselatus mundus, Chordeiles acutipennis texensis, Vireo bellii pusillus,* and *Guiraca caerulea salicarius.* In addition, however, there are several *races* which appear to be pecularly Lower Sonoran within the Great Valley of California, though belonging to *groups* of subspecies (that is, full species) which have wide zonal range, like *Otocoris alpestris, Agelaius phoeniceus,* and *Thomomys bottae.*

In view of this situation, a different course might have been justified, that is, to map the whole valley end of our Lassen section in yellow (Upper Sonoran) and merely call attention in the text to, perhaps, a "marked infusion of Lower Sonoran elements" along the lowest part of the Sacramento Valley trough.

But this, we have come to feel, would not express the case strongly enough; there should be presented, graphically, an indication of the fact that a strong representation of lower-zone kinds of animals, populations of the critical species being taken into account, extends at least as far north in the Great Valley of California as the vicinity of Red Bluff. Here the dilution with Upper Sonoran becomes, grantedly, pronounced; and, we have reason to believe, this Lower Sonoran "influence" plays out altogether a little way beyond the northern boundary of our section, certainly short of Redding, Shasta County.

It is notable, in this connection, if our interpretations be accepted, that the northward extension of the Lower Sonoran life-zone in the upper Sacramento Valley marks a more northern position of that zone (a little above the 40th parallel) than has been reported from any other place across the North American continent.

Of course, the "influence" just referred to is temperature, manifested in its bearing upon the existence of plant life and, less directly, upon the animal life, in general accordance with the tenets originally set forth by C. Hart Merriam, and subsequently illustrated in detail by this author (1899) in his study of the distribution of plants, birds, and mammals on Mount Shasta. The peculiar conditions that result in the summer heating of the upper Sacramento Valley (fig. 6) consist in the topographic configuration of the seaward north-south belt of northern California, with its series of high Coast Ranges, and the consequent northward deflection of the eastward-trending air currents entering the Great Valley at the San Francisco gap through the Coast Ranges. The dead-air area interiorly from the Yolla Bolly range of mountains permits the heating up of the air there in periods of relatively calm weather, and in windy weather the deflected air currents from the south traversing the long stretch of country toward the head of the Sacramento Valley warm up during their passage northward so as to accompany the well-known extreme of heat expected by travelers who pass through the Red Bluff district any time during the months from May to September, inclusive.

These same conditions, as just alluded to, doubtless also account for the high position of the upper limits of Upper Sonoran on the western slope of the Lassen section, averaging close to the 3000-foot contour. This is decidedly higher than the same zonal limit some 125 miles to the southward, on the west base of the central Sierra Nevada (in Placer and Eldorado counties) nearly opposite (that is, to the east of) the Golden Gate "gap." And the effects go farther, doubtless, in the generally higher position of the Boreal zonal limits in the Lassen section than on the main Sierra Nevada to the southward.

Mount Shasta is hardly comparable in this connection (see Merriam, 1899, pp. 52 ff.), for that mountain mass arises from a higher base level, is of larger area, and is certainly far less influenced by the topography to the westward. Additional factors in the Lassen region making for higher daily temperatures in summer are the prevalently westward slopes in the western third of the section, and there and elsewhere the great frequency of bare, open rock surfaces. Then, too, the generally meager precipitation in the eastern and western thirds of the section, together with the general absence of bodies of water or tracts of damp ground, makes for air temperatures unmodified by the cooling effects of evaporation (fig. 6).

On the whole, then, the Lassen section shows a lesser extent of the high (Boreal) life-zones and a correspondingly greater extent of the low (Austral) life-zones than its altitudes at that latitude would prescribe. And this characteristic is to be accounted for upon the basis of the physiographic features not only within its own area but as obtaining in the general Pacific Coast region of North America.

It will be noted that while we have indicated the presence of some Arctic-Alpine zone on the top of Lassen Peak (on the basis of the known presence there of certain "Arctic" species of plants), we were unable to find even a single Arctic-Alpine species of vertebrate animal. Among birds, there were no rosy finches, no pipits (in summer), for example. Only vagrant individuals of lower-zone species were found by us on top of Lassen Peak. In explanation, we may cite the extremely limited total area of land comprised in that portion of Lassen Peak above timber line (about 9600 feet altitude on favorable ridges on the western face of the Peak), as also within that area the fewness and meagerness of representation of ecologic niches—subsistence-affording units of occupancy *for* vertebrate species.

Even the Hudsonian zone lists are notable for their brevity, and this condition, too, may be ascribed to the smallness of the total area of this zone present, as well as, also, to its far sequestration from other Hudsonian areas to the northward (nearest, Mount Shasta) and to the southward (nearest, probably, in vicinity of Pyramid Peak, Lake Tahoe district of Sierra Nevada).

Examining, further, our zonal lists of vertebrate species, and referring also for details to the general accounts of the species farther along in this paper, it becomes at once apparent that the Austral species (those of Lower and Upper Sonoran and thence invading Transition, sometimes higher) far outnumber the Boreal species (those occurring in Hudsonian and Canadian and thence invading Transition). The figures are, leaving out exclusively Transition species (11 of them) and those of wide occurrence in both Austral and Boreal (38 species): essentially Austral species and subspecies, 166; essentially Boreal species and subspecies, 67.

To account for this 2.5 to 1 ratio, in numbers of kinds, of Austral to Boreal vertebrates in the Lassen section, despite its relatively northern latitude, we would call attention to the following circumstances. (1) The Austral elements represented in the two ends of the section are derived from *two* quite different faunal divisions, the Great Basin at the east and the Californian at the west; while the Boreal elements (nearly) all belong to one faunal division of Boreal, the Sierra Nevadan. (2) The two Austral faunal representations just referred to are in each case continuous with a vast area to the southward on either side of the Sierra Nevada, each area with, doubtless, a practically full complement of niche occupants; while the Boreal of the Lassen section is partly cut off from connection with extensive areas of Boreal both to the northward and to the southward by narrow necks of *dilute* Boreal (that is, Transition). In other words, only Boreal species of greatest degree of tolerance would, other factors for existence at the same time permitting, pass into the Lassen Boreal from one or the other direction in event of elimination of populations locally owing to extraordinary conditions unfavorable to persistence; *re*population would be less often possible. This is in accordance with the law that a small area of otherwise perfectly suitable territory is more hazardous for continuous occupancy by a given species than a larger area. (3) Scrutiny of our ecologic analysis of the Lassen section shows that there are more, and more diverse, ecologic niches included in the Austral portions of the territory than are included in the Boreal portions. This fact, *per se*, permits fewer niche occupants in the Boreal zones. For, in final analysis, there can be in any area no more species permanently established than can find separate support in matters of subsistence (food, shelter, and breeding places, of the right kinds and in sufficient amount).

It becomes of interest, next, to enquire more closely into the distributional behavior of at least some of the representative species in each zonal and faunal category.

FAUNAL RELATIONS

Allusion has been made in the preceding section to the fact that the Austral group of vertebrate species is represented in the Lassen section by two sharply different faunas, the Great Basin and the Californian. In a general way, and geographically speaking, these two faunas in relative purity occupy the eastern and western thirds of our section, respectively. But because the base level of the Great Basin (see fig. 3) extends west to the very edge of the declivity of the Sacramento Valley without any lofty and continuous intervening ridge or divide (low gaps extend between the separate volcanic cones), we find here no such sharp Boreal barrier between the two faunal areas named as exists in the central Sierra Nevada to the southward. No zone higher than Transition (upper) occupies some of the gaps between peaks across from the Great Basin to the Sacramento Valley with its Californian fauna. Also, even slightly lower zonal conditions than are afforded within the restricted width of our Lassen section exist not far to the northward, at the Pit River gap, and to the southward at the Feather River gap. (For discussion of these zonal "gaps" and their significance, see Merriam, 1899, pp. 69 ff.)

It thus happens that there exists what we found to be the case in the Lassen region—a significant interplay in the distributional behavior of the more tolerant Austral types of vertebrates in the two east and west faunas named. An analysis of the facts as disclosed by our field work is now in order, as also a discussion of certain of the individual cases.

In the lists immediately following, account is taken only of species whose manner of occurrence is well enough known to make their citation here of real significance. Also, just as in zonal considerations, only the breeding ranges of migratory species are heeded.

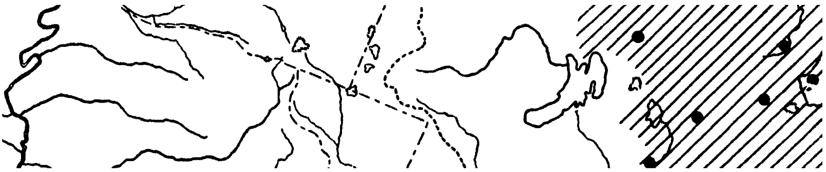


Fig. 82. Range of *Centrocercus urophasianus.* In this and the succeeding diagrammatic maps the position of the topographic "divide" (not any faunal boundary) between the Great Basin and western slope is indicated by the strong, broken line extending down curvingly across the section.

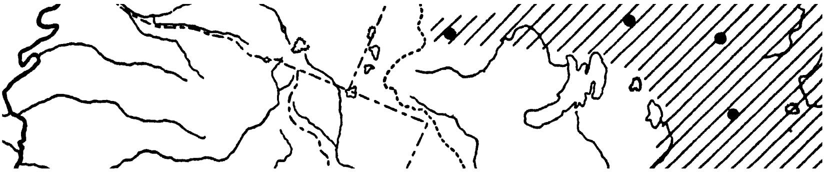


Fig. 83. Range of *Antilocapra americana.*

Figures 82 and 83 are examples of distributional behavior from list 1, on this page.

1. Austral species of the Great Basin fauna which in the Lassen section are not known to occur to the westward of the western border of the Great Basin faunal territory. (As examples, see figs. 82, 83, and 86.)

Uta stansburiana stansburiana
Scaphiopus hammondii
Centrocercus urophasianus
Larus californicus
Empidonax griseus
Cyanocephalus cyanocephalus
Telmatodytes palustris plesius
Oroscoptes montanus
Pooecetes gramineus confinis
Amphispiza belli nevadensis
Amphispiza bilineata deserticola
Myotis subulatus melanorhinus
Eutamias minimus pictus
Thomomys quadratus quadratus
Perognathus parvus mollipilosus
Dipodomys ordii columbianus
Microdipodops megacephalus oregonus
Onychomys leucogaster fuscogriseus
Peromyscus crinitus crinitus
Neotoma intermedia nevadensis
Ondatra zibethica mergens
Antilocapra americana americana

2. Species (in some cases, subspecies) of the Californian fauna which in the Lassen section have not been found to occur eastwardly across the central Boreal tract. (As examples, see figs. 84 to 86 and 95.)

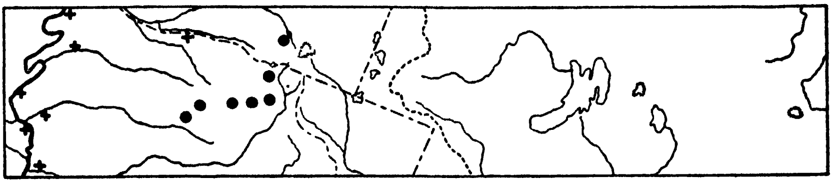


Fig. 84. Record stations of *Gerrhonotus scincicauda scincicauda* (crosses) and *G. palmeri* (spots).

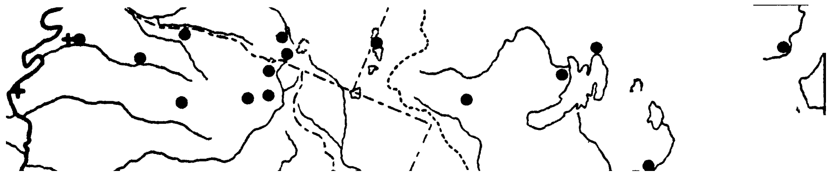


Fig. 85. Record stations of *Chordeiles acutipennis texensis* (crosses) and *C. minor hesperis* (spots).

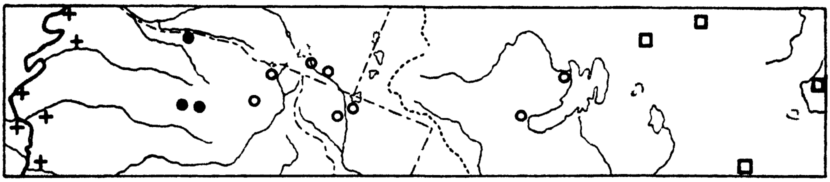


Fig. 86. Record stations of *Thomomys bottae navus* (crosses), *T. b. leucodon* (spots), *T. monticola monticola* (circles) and *T. quadratus quadratus* (squares).

Figures 84 to 86 are examples of distributional behavior from list 2. Figure 86 also shows records of other closely related races, one of which represents a species in list 1.

Rana aurora draytonii
Rana boylii boylii
Gerrhonotus scincicauda scincicauda
Cnemidophorus tesselatus mundus
Eumeces skiltonianus
Coluber lateralis
Lampropeltis getulus boylii
Contia tenuis
Thamnophis sirtalis infernalis
Clemmys marmorata
Butorides virescens anthonyi
Aix sponsa
Elanus leucurus majusculus
Buteo lineatus elegans
Geococcyx californianus
Otus asio quercinus

Chordeiles acutipennis texensis
Calypte anna
Balanosphyra formicivora bairdi
Dryobates nuttallii
Sayornis nigricans semiatra
Corvus brachyrhynchos hesperis
Chamaea fasciata henshawi
Toxostoma redivivum sonomae
Polioptila caerulea amoenissima
Vireo bellii pusillus
Agelaius tricolor
Guiraca caerulea salicarius
Spinus tristis salicamans
Pipilo fuscus carolae
Pipistrellus hesperus merriami
Nycteris borealis teliotis

Corynorhinus rafinesquii intermedius
Antrozous pallidus pacificus
Tadarida mexicana
Bassariscus astutus raptor
Urocyon cinereoargenteus californicus
Otospermophilus douglasii

Sciurus griseus griseus
Thomomys bottae (both subspecies, navus and leucodon)
Dipodomys heermanni saxatilis
Peromyscus boylii boylii
Neotoma fuscipes streatori
Microtus californicus eximius

3. Species distinctly of the Great Basin fauna which have penetrated westwardly more or less far beyond the western edge of the Great Basin proper.. (As examples, see figs. 87 and 88.)

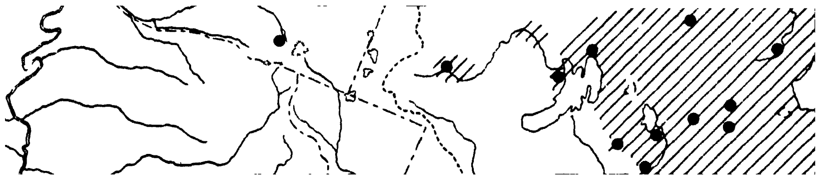


Fig. 87. Range and record stations of *Spizella breweri*.

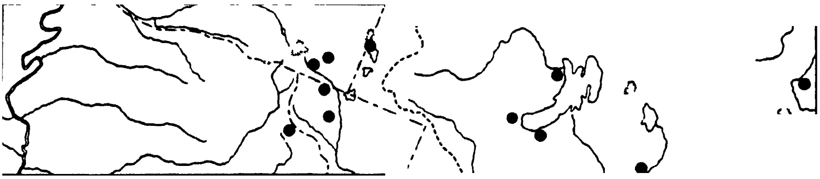


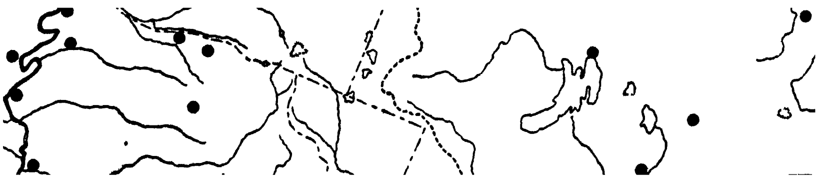
Fig. 88. Record stations of *Citellus oregonus*.

Figures 87 and 88 are examples of distributional behavior from list 3.

Querquedula cyanoptera
Buteo swainsoni
Steganopus tricolor
Xanthocephalus xanthocephalus
Oberholseria chlorura
Passerculus sandwichensis nevadensis

Spizella breweri
Canis lestes[?]
Citellus oregonus
Microtus montanus yosemite
Odocoileus hemionus hemionus

4. Species or subspecies distinctly of the Californian fauna which occur eastwardly through the intervening Boreal territory, or via one or the other of the "gaps" to the north or south of the section, to, or more or less far out into, Great Basin territory. (As examples, see figs. 89 to 95.)



89. Record stations of *Sceloporus occidentalis occidentalis*.

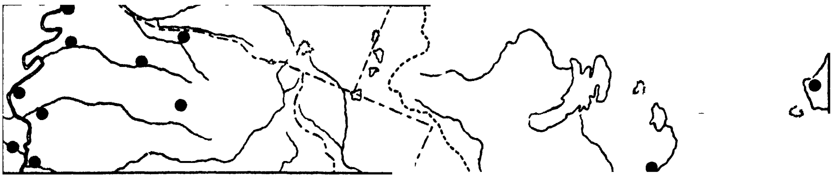


Fig. 90. Record stations of *Lophortyx californica vallicola.*

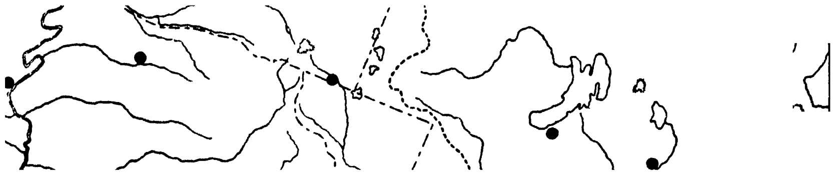


Fig. 91. Record stations of *Phalaenoptilus nuttallii californicus.*

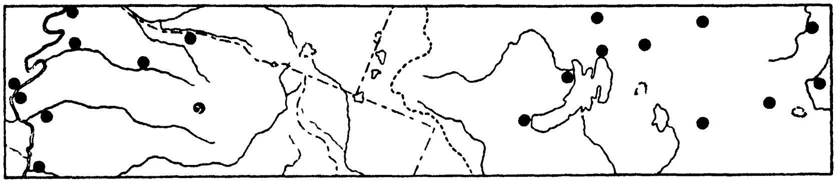


Fig. 92. Record stations of *Aphelocoma californica immanis.*

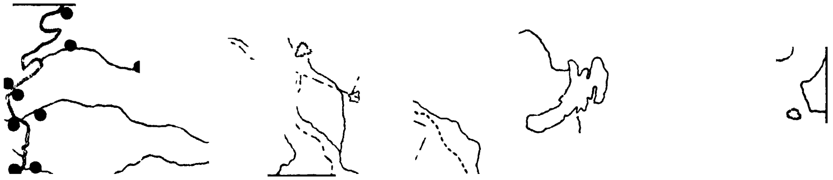


Fig. 93. Record stations of *Thryomanes bewickii drymoecus.*

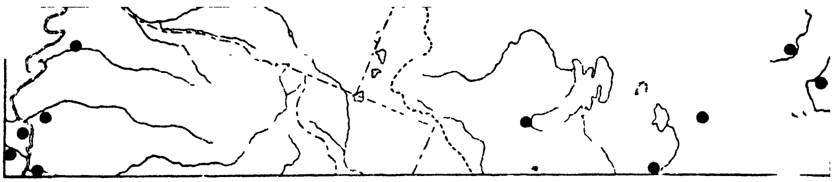


Fig. 94. Record stations of *Lanius ludovicianus gambeli.*

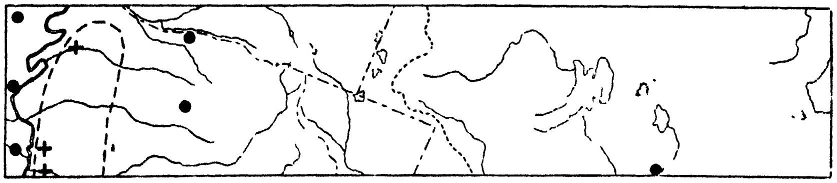


Fig. 95. Record stations of *Dipodomys heermanni saxatilis* (crosses: assumed range outlined by broken line) and *D. h. californicus* (spots).

Figures 89 to 95 are examples of distributional behavior from list 4. Figure 95 also represents list 2.

Sceloporus occidentalis occidentalis
Coluber constrictor mormon
Crotalus oreganus
Ardea herodias hyperonca
Lophortyx californica vallicola [but with the possibility that the east-side stock was planted there]
Phalaenoptilus nuttallii californicus
Progne subis subis
Aphelocoma californica immanis
Thryomanes bewickii drymoecus
Lanius ludovicianus gambeli
Procyon lotor psora
Dipodomys heermanni californicus

5. Species represented in both the Great Basin fauna and the Californian fauna, but by different subspecies, intergradation between these taking place either directly over intervening and more or less continuously inhabited territory, or circuitously via routes at more or less distance to the southward. (As examples, see figs. 96 to 110.)

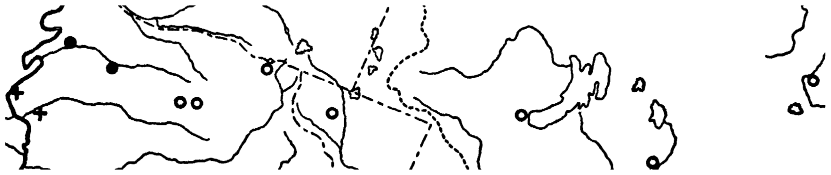


Fig. 96. Record stations of *Thamnophis ordinoides atratus* (crosses), *T. o. couchii* (spots), and *T. o. elegans* (circles).

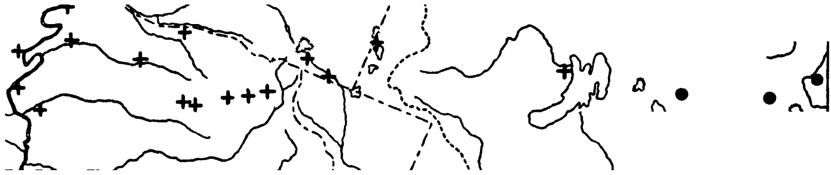


Fig. 97. Record stations of *Bubo virginianus pacificus* (crosses) and and *B. v. occidentalis* (spots).

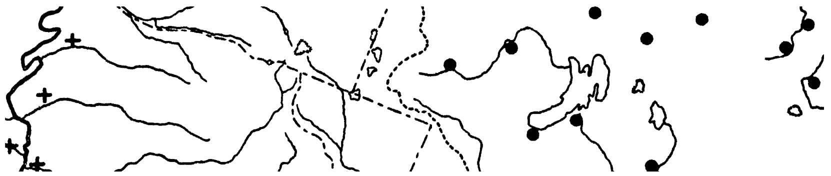


Fig. 98. Record stations of *Otocoris alpestris rubea* (crosses) and *O. a. merrilli* (spots).

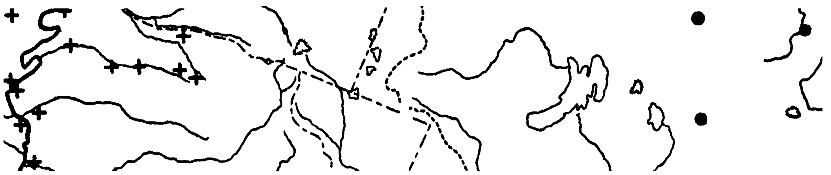


Fig. 99. Record stations of *Baeolophus inornatus inornatus* (crosses) and *B. i. griseus* (spots).

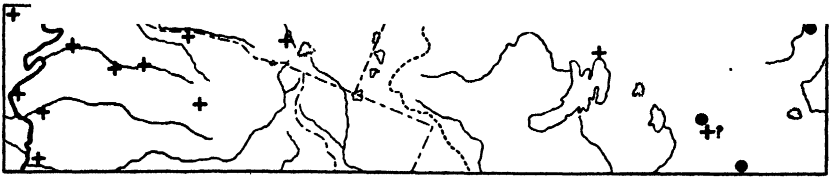


Fig. 100. Record stations of *Psaltriparus minimus californicus* (crosses) and *P. m. plumbeus* (spots). For discussion of this case, see text, page 315.

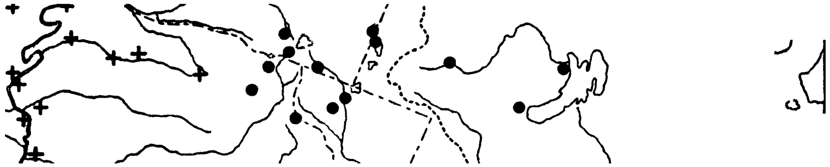


Fig. 101. Record stations of *Sitta carolinensis aculeata* (crosses) and *S. c. nelsoni* (spots).

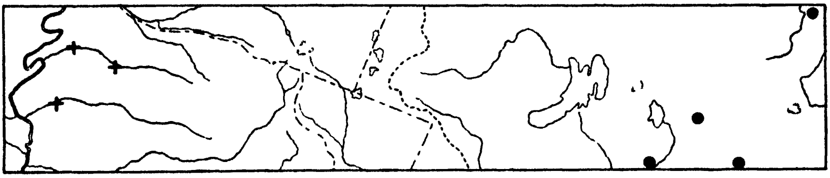


Fig. 102. Record stations of *Catherpes mexicanus punctulatus* (crosses) and *C. m. conspersus* (spots).

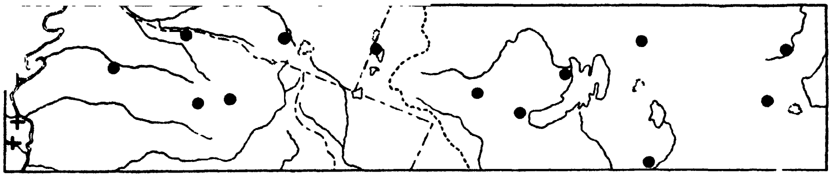


Fig. 103. Record stations of *Agelaius phoeniceus californicus* (crosses) and *A. p. nevadensis* (spots).

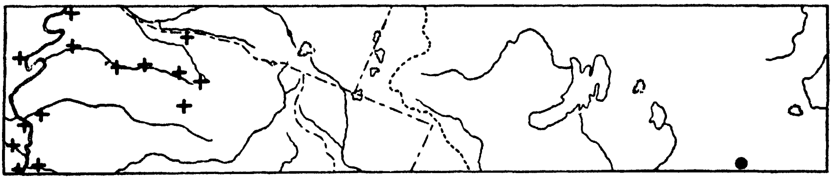


Fig. 104. Record stations of *Pipilo maculatus falcinellus* (crosses) and *P. m. curtatus* (spot).

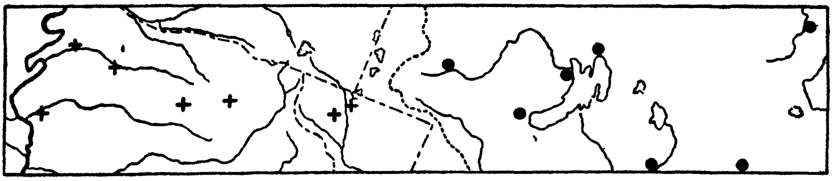


Fig. 105. Record stations of *Passerella melodia mailliardi* (crosses) and *P. m. fisherella* (spots).

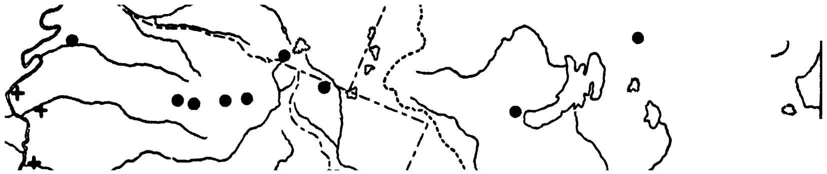


Fig. 106. Record stations of *Scapanus latimanus latimanus* (crosses) and *S. l. dilatus* (spots).

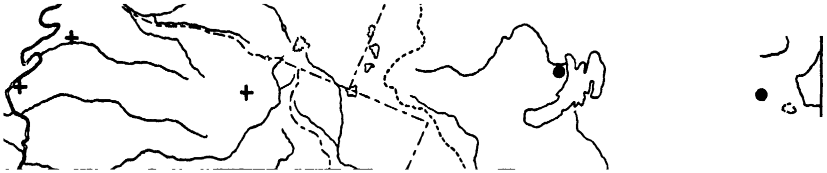


Fig. 107. Record stations of *Mephitis occidentalis occidentalis* (crosses) and *M. o. major* (spots).

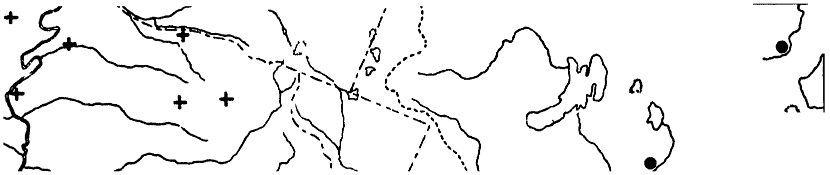


Fig. 108. Record stations of *Reithrodontomys megalotis longicaudus* (crosses) and *R. m. megalotis* (spots).

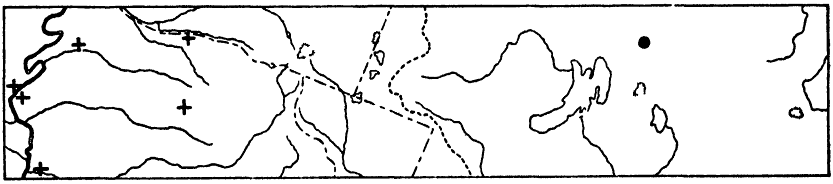


Fig. 109. Record stations of *Peromyscus truei gilberti* (crosses) and *P. t. truei* (spot).

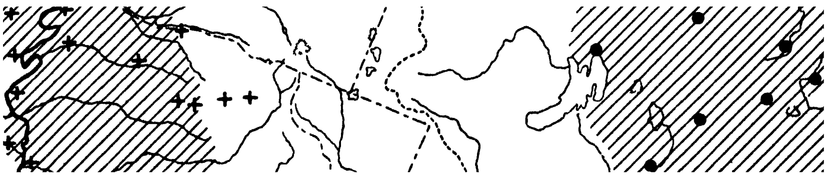


Fig. 110. Record stations and ranges of *Lepus californicus californicus* (crosses) and *L. c. wallawalla* (spots).

Figures 96 to 110 are examples of distributional behavior from list 5.

Pituophis catenifer	deserticola heermanni
Thamnophis ordinoides	elegans couchii
Bubo virginianus	occidentalis pacificus
Dryobates pubescens	leucurus turati
Otocoris alpestris	merrilli rubea
Baeolophus inornatus	griseus inornatus
Psaltriparus minimus	plumbeus californicus
Sitta carolinensis	nelsoni aculeata
Catherpes mexicanus	conspersus punctulatus
Agelaius phoeniceus	nevadensis californicus
Pipilo maculatus	curtatus falcinellus
Passerella melodia	fisherella mailliardi
Scapanus latimanus	dilatus latimanus
Mephitis occidentalis	major occidentalis
Lynx rufus	pallescens californicus
Reithrodontomys megalotis	megalotis longicaudus
Peromyscus truei	truei gilberti
Lepus californicus	wallawalla californicus

6. Closely related species occupying, respectively, the Great Basin and Californian faunas, but whose ranges are wholly separated and between which intergradation in the geographic sense is not known to take place. (As examples, see figs. 111 and 112.)

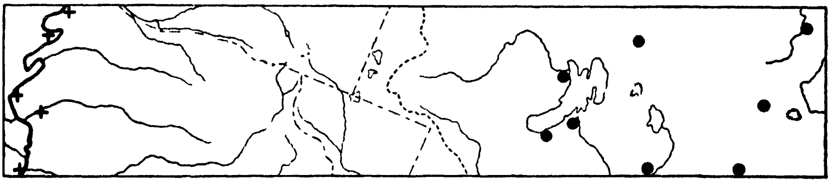


Fig. 111. Record stations of *Pica nuttallii* (crosses) and *P. pica hudsonia* (spots).

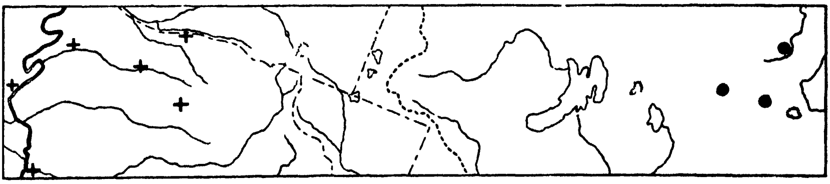


Fig. 112. Record stations of *Sylvilagus bachmani bachmani* (crosses) and *S. idahoensis* (spots).

Figures 111 and 112 are examples of distributional behavior from list 6.

Pica pica (hudsonia)	Pica nuttallii
Spilogale gracilis (saxatilis)	Spilogale phenax (phenax)
Sylvilagus nuttallii (nuttallii)	Sylvilagus audubonii (audubonii)
Sylvilagus bachmani (bachmani)	Sylvilagus idahoensis

7. Species of the Lassen section which occur indifferently in both the Great Basin fauna and the Californian fauna, as well as, in some cases, in the interlying territory. (As examples, see figs. 113 to 115.)

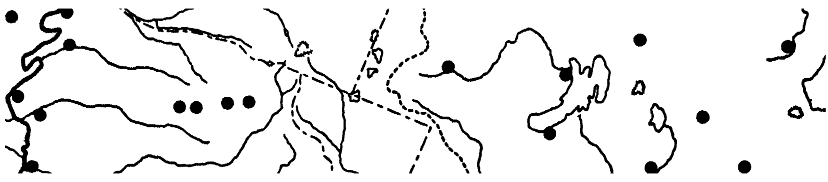


Fig. 113. Record stations of *Sturnella neglecta.*

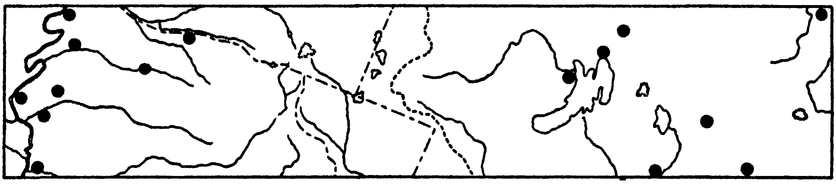


Fig. 114. Record stations of *Icterus bullockii.*

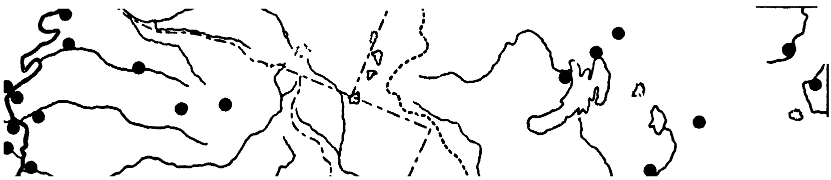


Fig. 115. Record stations of *Carpodacus mexicanus frontalis.*

Figures 113 to 115 are examples of distributional behavior from list 7.

Nycticorax nycticorax naevius
Anas platyrhynchos platyrhynchos
Cathartes aura septentrionalis
Accipiter cooperii
Buteo borealis calurus
Aquila chrysaëtos
Falco mexicanus
Falco sparverius phalaena
Oxyechus vociferus vociferus
Zenaidura macroura marginella
Tyto alba pratincola
Speotyto cunicularia hypugaea
Colaptes cafer collaris
Tyrannus verticalis
Myiarchus cinerascens cinerascens
Stelgidopteryx ruficollis serripennis
Hirundo rustica erythrogaster
Petrochelidon albifrons albifrons
Corvus corax sinuatus
Troglodytes aëdon parkmanii
Salpinctes obsoletus obsoletus
Mimus polyglottos leucopterus [so rare on either side as to be scarcely significant in this connection]
Dendroica nigrescens
Geothlypis trichas occidentalis
Icteria virens longicauda
Sturnella neglecta
Icterus bullockii
Euphagus cyanocephalus minusculus
Zamelodia melanocephala capitalis
Passerina amoena
Passer domesticus domesticus
Carpodacus mexicanus frontalis
Spinus psaltria hesperophilus
Chondestes grammacus strigatus
Taxidea taxus neglecta

The western margin of the Great Basin faunal district practically coincides with the western margin of the Upper Sonoran life-zone, east of the altitudinal divide through the section, as marked on our life-zone map (fig. 2). This faunal margin, it will be seen, passes transversely of our section practically through the middle of Eagle Lake. The Great Basin territory which is thus included in the Lassen section must be looked upon, in view of the general topography, as an upper marginal shelf of the Great Basin proper, as the latter is represented to the southward and eastward. Some of the faunal and floral elements characteristic of the latter do not reach the Lassen area at all. This factor may in some degree account for the relatively numerous extensions of Californian species and races more or less far out onto this marginal Great Basin shelf. Absence there of the more restricted Great Basin niche occupants leaves places in which the more adaptable sorts of pioneers from the fauna beyond may settle.

However, in the cases of these Californian species which are also represented in the eastern portion of the section the responses to differing conditions which go along with the different climates represented are reflected in the annual cycles of activity of the species. There is rather general agreement in the group to the eastward. The development of the breeding cycle is there retarded by as much as two months even in the same species. This lag in seasonal development is indicated roughly in the accompanying hythergraphs (figs. 6 and 7). These differences in seasonal responses are no doubt bound up with many sorts of differing factors, such as seasonal change in the vegetation and in the invertebrate fauna of the region.

A study of the seven lists given above (pp. 98–106) shows two things rather opposed to one another: (1) conspicuous lack of exact concordance in distributional behavior among the species listed, save in a very few cases; (2) certain significant circumstances that seem to account for the gross groupings which make the separate listings possible.

It is to be noted that our list 7, of species which occur indifferently at both faunal ends of the Lassen section as well as, in many cases, on intervening ground of appropriate nature, consists chiefly of kinds that are strong of flight, if not also freely migratory, and that range widely across western North America, even the whole of the continent in some cases. Also, for the most part they have food habits which necessitate foraging individually, and over much territory, for their food. Only one species is a mammal, and this one, the badger, is a notorious wanderer.

Contrasted with this set are those species included in lists 1 to 6, which are more or less restricted in distribution. These will be observed to be predominantly non-migratory, many of them of extremely weak powers of locomotion, capable of covering individually but relatively small neighborhoods. Mammals, reptiles, and amphibians are represented, as well as a somewhat larger proportion of *sedentary* birds than in list 7.

Lists 5 and 6 are significant for speciation, in that a portion (perhaps a fair sample on an average) of the barrier is represented in each case which has operated to permit the formation of two races or differentiates, or else to keep them separated in the cases of forms that have been differentiated elsewhere more nearly in the metropolises of the two faunal areas involved and have spread toward one another.

In general, the line of demarcation between two related differentiates falls pretty well at the summit of the divide (shown in strong broken line on the accompanying maps of selected cases) between the Great Basin and Californian faunal areas. But various conditions are seen: (1) where two differentiates are completely separated by mid-sectional territory uninhabited by either; (2) where two subspecies have their mean line of intergradation (*a*) more or less far over toward the Sacramento Valley, or where this line is (*b*) more or less far over to the east of the divide, onto Great Basin territory. As additional illustration of the latter are most of the species from list 4, in which intergradation with their Great Basin counterparts takes place entirely east of the eastern end of our section.

It would appear that habitat conditions, differently reacting for the several species in this category, operate to determine the different lines of limitation or of intergradation.

Another factor taking part here is doubtless radial momentum of spreading populations from centers outside our section. To illustrate: The Great Basin race of *Agelaius phoeniceus, nevadensis,* was found to extend, though interruptedly because of habitat conditions, far across the divide down into the Sacramento trough. The complementary race, *californicus,* of the Sacramento–San Joaquin basin, was found only sparsely along the lowest part of the Sacramento River valley, here at the northern limit of its range. We interpret the situation by saying that the stream of pioneers seeking breeding grounds from year to year, from the direction of the metropolis of *nevadensis* on the Great Basin plateau, has a greater volume or rate of current, or both, than the counter stream of individuals coming from year to year up the Sacramento Valley from the metropolis of *californicus.* The same factor, though obviously difficult of satisfactory definition, doubtless obtains as regards Californian races which were found to dominate in the opposite direction.

In final analysis, of course, behavior of races on the margins of their habitats is dependent upon ecologic factors—those obtaining in the main portion of their general ranges as well as actually at the borders of those ranges. The situation of eastward or westward limits of occurrence of a given species, or of a differentiate, doubtless shifts from year to year according to population pressures.

Still another factor plausibly entering for consideration in this problem is continuity of favorable habitat conditions. If at (between) the margins of the general ranges of two species or races the appropriate habitat becomes interrupted (representations of it sequestered by intervals of uninhabitable ground) then the widths of the intervals will determine the distances to which the complementary populations will extend; that is, referring again to *Agelaius*, a series of more closely situated marshy areas from the direction of the main range of *nevadensis* than from the direction of the main range of *californicus* will make for farther extension of *nevadensis,* and this at the expense, territorially, of *californicus.*

In considering the aggregate of species comprised in the "Boreal" zonal division as contrasted with the "Austral," we take into account only species whose metropolis normally lies in the Canadian, in the Hudsonian, or in the Canadian and Hudsonian together, although some of them do range down into Transition as well. In other words, species belonging to the Transition primarily or mainly are not used here. Also species are not included of whose status we know too little to make them significant in this connection.

In the following lists, Boreal species are so grouped as to disclose something of what may be indicated as regards the proper faunal allocation of the Lassen highlands with the main mountain regions to the north and to the south.

Boreal species and subspecies in the Lassen section which occur also both in the main Cascade Mountains of Oregon or Washington and in the main Sierra Nevada:

Bufo boreas boreas [chiefly in Cascades]

Sceloporus graciosus gracilis

Branta canadensis canadensis

Glaucionetta islandica
Mergus americanus
Astur atricapillus
Accipiter velox
Oreortyx picta picta
Capella delicata
Columba fasciata fasciata
Chordeiles minor hesperis
Stellula calliope
Ceophloeus pileatus picinus
Sphyrapicus varius daggetti
Sphyrapicus thyroideus thyroideus
Dryobates villosus orius
Xenopicus albolarvatus albolarvatus
Picoides arcticus
Empidonax hammondii
Empidonax wrightii
Myiochanes virens richardsonii
Nuttallornis mesoleucus majorinus
Nucifraga columbiana
Penthestes gambeli abbreviatus
Sitta canadensis
Sitta pygmaea pygmaea
Certhia familiaris zelotes
Cinclus mexicanus unicolor
Turdus migratorius propinquus
Hylocichla guttata sequoiensis
Hylocichla ustulata ustulata
Sialia mexicana occidentalis
Sialia currucoides
Myadestes townsendi
Regulus satrapa olivaceus
Vireo solitarius cassinii
Vermivora ruficapilla gutturalis
Vermivora celata lutescens
Dendroica auduboni auduboni
Dendroica occidentalis
Oporornis tolmiei
Wilsonia pusilla chryseola
Piranga ludoviciana
Hesperiphona vespertina brooksi
Carpodacus purpureus californicus
Carpodacus cassinii
Spinus pinus pinus
Spizella passerina stridula
Zonotrichia leucophrys leucophrys
Passerella lincolnii lincolnii
Sorex palustris navigator
Myotis volans interior
Myotis californicus californicus
Lasionycteris noctivagans
Martes pennanti pacifica
Mustela vison energumenos
Vulpes fulva necator
Marmota flaviventer flaviventer
Callospermophilus chrysodeirus chrysodeirus
Eutamias amoenus amoenus
Eutamias senex
Erethizon epixanthum epixanthum
Lepus washingtonii klamathensis

Boreal species and subspecies in the Lassen section which are the same as occur in the Sierra Nevada, but do not occur in the main Cascade Mountains of Oregon or Washington:

Ensatina sierrae
Gerrhonotus palmeri
Dendragapus obscurus sierrae
Cyanocitta stelleri frontalis
Corthylio calendula cineraceus [possibly also on at least southern Cascades]
Loxia curvirostra bendirei
Junco oreganus thurberi
Passerella iliaca mariposae [fox sparrows apparently absent from main Cascades]
Sorex trowbridgii mariposae
Sorex vagrans amoenus
Myotis lucifugus carissima
Ursus americanus californiensis [status in Cascades not known definitely]
Martes caurina sierrae
Mustela muricus
Eutamias speciosus frater
Sciurus douglasii albolimbatus
Glaucomys sabrinus lascivus
Thomomys monticola monticola
Microtus mordax sierrae
Aplodontia rufa californica
Zapus pacificus alleni
Ochotona schisticeps schisticeps

Boreal species and subspecies in the Lassen section which are the same as occur in the main Cascade Mountains of Oregon or Washington, and do not occur in the main Sierra Nevada:

- Rana pretiosa pretiosa
- Gavia immer [next southernmost known breeding station, in Washington]
- Charitonetta albeola
- Chaetura vauxii [no good breeding record from Sierra Nevada]
- Neürotrichus gibbsii gibbsii
- Neotoma cinerea occidentalis
- Evotomys mazama

Boreal subspecies occurring in the Lassen section which are the same as occur on the Warner Mountains of extreme northeastern California (figs. 116 to 118):

- Passerella iliaca fulva
- Microtus mordax mordax
- Ochotona schisticeps taylori

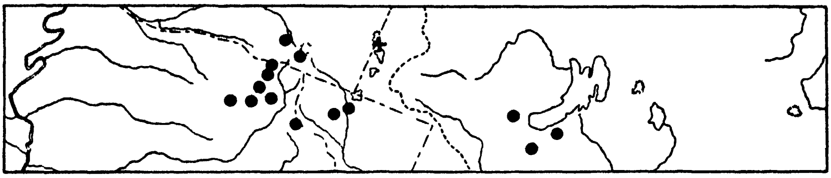


Fig. 116. Record stations of *Passerella iliaca mariposae* (spots) and *P. i. fulva* (cross).

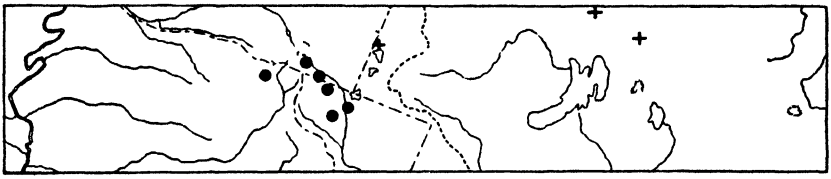


Fig. 117. Record stations of *Microtus mordax sierrae* (spots) and *M. m. mordax* (crosses).

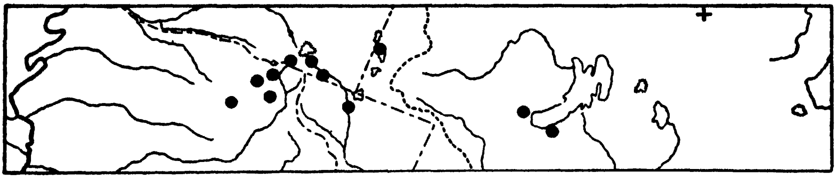


Fig. 118. Record stations of *Ochotona schisticeps schisticeps* (spots) and *O. s. taylori* (cross).

Figures 116 to 118 are examples of boreal species in the section which are represented there by two subspecies, the northeastwardly located of which in each case is typical, or most nearly so, in the Warner Mountains of northeastern California.

Boreal species found on Mount Shasta that have not been found on or near Lassen Peak:

- Perisoreus obscurus griseus [the record for "Lossen's butte" is not considered valid: see p. 295]
- Anthus spinoletta rubescens
- Leucosticte "tephrocotis" [subspecies on Shasta uncertain]
- Phenacomys intermedius intermedius
- Cervus "occidentalis" (formerly)
- Ovis "canadensis" (formerly)

Boreal species found on or around Lassen Peak that have not been found on Mount Shasta:

Several anatid birds	Marmota flaviventer flaviventer
Mustela muricus	Eutamias speciosus frater

From the above lists it is learned that 63 species of predominantly Boreal occurrence as regards the Lassen Peak area occur also both on the Cascade Mountains and the Sierra Nevada. Twenty-two others of the Lassen area are found otherwise on the Sierra Nevada but not on the Cascades. Only 7 species (merely a subspecies in one case) occur on Lassen and on the Cascades but not on the Sierra Nevada. As regards its Boreal fauna, then, it is clear that Lassen "belongs" to the Sierra Nevadan fauna rather than to that of the Cascades.

Comparisons with Mount Shasta, across the Pit River gap, whose bird and mammal faunas have been carefully analyzed by Merriam (1899, pp. 69 ff.), show few differences, and these are readily accounted for. It is necessary to modify his lists somewhat, just as he foretold, because of subsequent systematic revisions, and because of further increments of distributional knowledge. When this is done, we find that all the Boreal species and subspecies of the Lassen Peak area are found also on Mount Shasta excepting certain anatid birds whose absence as breeding species on or around Shasta is easily accounted for by total lack of lakes there, and excepting three essentially Sierra Nevadan mammals. Of these, *Mustela muricus* is an elusive species; it has been found in the Trinity region to the west of Shasta (Kellogg, 1916, p. 358), and therefore its existence on Shasta also is hardly to be doubted. *Marmota* exists on the southern Cascades to the northward of Shasta and in the Modoc region of northeastern California nearly up to the eastern base of Shasta; actual specimens have been taken north of the Pit River gap. There remains the chipmunk, *Eutamias speciosus frater,* whose species, of seemingly Sierran faunal origin, does find its northernmost limits on the Lassen highlands; it has never been found on Shasta or elsewhere north of the Pit River gap.

Here, then, is just one vertebrate for which the "gap" just named may be considered effective. The chipmunk is an arboreal mammal, of Canadian zone metropolis, and its numbers around Lassen are large, as if the species had long been well established. Discontinuity of high-zone forest across the Pit River gap is greater than across the Feather River (Quincy) gap, as has already been pointed out, and the significance stressed, by Merriam.

As regards the six species here listed for Mount Shasta and as not belonging on Lassen, the lack of good habitable Arctic-Alpine on Lassen may be held to account for the absence on the latter mountain mass, of *Anthus* and *Leucosticte.* The *Phenacomys* is difficult to trap; only three specimens have been taken on Shasta; heather patches in which this rodent lives, occur in considerable extent immediately around Lassen; it could be present there and have escaped our efforts to trap it. The seeming absence of this rodent from Lassen cannot therefore be given significance. In view of the well attested presence of *Perisoreus* on Shasta, as also on the Warner Mountains, its absence from Lassen must be explained; so conspicuous a bird as the "Canada" jay could hardly have been overlooked. This is, among corvids, notably sedentary; it is not so prone as other jays to wander outside its normal habitat. As to habitat, *Perisoreus* stays within or close to dense forest; and as to zonal position this is high—red fir and up. For this Boreal bird, then, the wide stretch of unfavorable country south of Shasta may well account for its not having reached, or at least become established on, Lassen; and it may be remarked here that there is no good record for even a stray south of the latitude of Shasta in the approximate longitude of the Sierra Nevada.

As for the remaining two species on the list of Shasta-present absentees from Lassen, the elk and bighorn, we only know that no trace of either has been found within historical times immediately around Lassen. The sheep, at least, we know to have existed in eastern Lassen County, and there is no good ground for denying its former occurrence to the westward along open lava-cap country. The elk is a wide-ranging type of ruminant and at times it reached relatively low levels altitudinally; we can see no reason why it did not reach the Lassen highlands; maybe it did.

To summarize concerning the Boreal vertebrates of the Lassen section: Although orogenetically Lassen belongs definitely to the Cascade Mountains, faunally it is most closely allied with the Sierra Nevada. Indeed, along with Mount Shasta, despite the intervention of certain zonal "gaps" its vertebrate animal life is overwhelmingly that which is characteristic of the central Sierra Nevada.

However, the Lassen highlands are reached by a few forms (seven) from the north which appear not to extend much if any farther to the southward; and a very few (three) reach the section from the direction of the Warner Mountains to the northeastward. But here enter questions relating to subspecific behavior which may have little or nothing to do with the life-zone concept (see Grinnell, 1916, pp. 405 ff.).

Finally, despite its appearance of topographic isolation, the Lassen mountain mass possesses no exclusive differentiate among its vertebrate animals, in so far as has yet been determined.

POPULATIONS OF BIRDS

From the beginnings of our field work in the Lassen section a portion of our effort at each station was expended toward obtaining estimates of population sizes in birds, both as regards species and as existing in the same species from season to season and place to place. The method which we employed, selected at the outset because practicable consistently with the other aims of our field work, was the one based on *time* and described fully, together with a discussion of its shortcomings as well as its advantages, elsewhere (Grinnell and Storer, 1924, pp. 22 ff.).

Briefly, for each census a pencil check is kept as to species and individuals observed per hour of active travel along a selected route. Travel is usually on foot, at a slow or at least moderate rate; and when at the close of the day the formal census record is entered in the regular field notebook rather full comment is entered as to habitats traversed, conditions of the weather, hours of the day involved, and other factors bearing upon the enumeration.

It will be seen that, by this method of census-taking, area is concerned, to a degree, as well as the more definitely apparent unit of time. On the latter basis, censuses so taken may be compared, with opportunity for drawing significant inferences as to season and as to year, and as to habitat, faunal district and life-zone.

In the following pages we present, to serve as quantitative "pictures" of the Lassen avifauna, a series of censuses selected from the more than fifty we recorded. These samples, to be fully understood, should be considered in connection with our descriptions and photographs of habitats. To facilitate use, cross-references have been introduced freely. Vernacular names are employed here because of their supposed more ready adoption, at least in abbreviated form, by users of this system of census taking.

Sacramento River immediately below bridge at Red Bluff; from boat floating with current, audibility perfect; May 13, 1924, 3:50 to 4:50 p.m.; day clear; distance covered, between 2 and 3 miles, on open

river, margined by riparian growths (see fig. 18), blue oaks reaching river bank part way on right-hand side (J. G.).

California Great Blue Heron	4
Anthony Green Heron	4
American Black-crowned Night Heron	2
Wood Duck	2
Northern Turkey Vulture	1
Western Sparrow Hawk	1
Interior Valley Quail	3
Northern Killdeer	1
Spotted Sandpiper	5
Western Mourning Dove	13
Monterey Red shafted Flicker	2
California Acorn storing Woodpecker	14
Nuttall Ladder backed Woodpecker	1
Western Kingbird	6
Northern Ash throated Flycatcher	1
Western Wood Pewee	4
Tree Swallow	5
Interior California Jay	3
Yellow billed Magpie	11
Western American Crow	3
California Plain Titmouse	1
Slender billed White breasted Nuthatch	1
Western House Wren	1
Sacramento Bewick Wren	2
Sonoma California Thrasher	1
Western Blue gray Gnatcatcher	2
Cedar Waxwing	5
Least Bell Vireo	3
Western Warbling Vireo	5
California Yellow Warbler	9
Long tailed Yellow breasted Chat	2
Western Meadowlark	6
Bullock Oriole	2
California Brewer Blackbird	2
Pacific Black headed Grosbeak	4
California Linnet	11
Willow American Goldfinch	2
Green backed Arkansas Goldfinch	2
Sacramento Brown Towhee	1
Western Lark Sparrow	2

Total: species 40, individuals 150, in one hour.

Sacramento River approaching Tehama to within sight of bridge; from boat floating with current or rowed gently; May 14, 1924, 8:05 to 9.05 a.m.; day clear; distance covered, approximately 3 miles, on open river margined by riparian growths (J. G.).

American White Pelican	6
Farallon Double crested Cormorant	2
California Great Blue Heron	5
Cackling Canada Goose	1

Lesser Snow Goose	1
Cinnamon Teal	2
Wood Duck	7
American Merganser	2
Northern Turkey Vulture	5
Western Red-tailed Hawk	1
Western Sparrow Hawk	1
Interior Valley Quail	1
Northern Killdeer	7
Spotted Sandpiper	5
Western Mourning Dove	8
Western Belted Kingfisher	2
Monterey Red-shafted Flicker	3
California Acorn-storing Woodpecker	6
Nuttall Ladder-backed Woodpecker	3
Western Kingbird	4
Northern Ash-throated Flycatcher	4
Western Wood Pewee	2
Tree Swallow	3
Northern Rough-winged Swallow	5
Northern Purple Martin	2
Interior California Jay	6
Western American Crow	1
California Plain Titmouse	2
Western House Wren	4
Sacramento Bewick Wren	1
Least Bell Vireo	2
Western Warbling Vireo	6
California Yellow Warbler	10
Western Yellow-throat	6
Long-tailed Yellow-breasted Chat	6
Western Meadow-lark	1
California Red-winged Blackbird	6
Bullock Oriole	3
Pacific Black-headed Grosbeak	12
California Blue Grosbeak	1
Lazuli Bunting	1
California Linnet	4
Willow American Goldfinch	8
Sacramento Spotted Towhee	5
Sacramento Brown Towhee	3
Modesto Song Sparrow	1

Total: species 46, individuals 177, in one hour.

Tehama and vicinity, chiefly on the eastern side of the Sacramento River; December 28, 1927, 1:00 to 2:30 p.m.; day cloudy with strong wind; distance covered, between 1 and 2 miles, through riparian strip where large sycamore trees were laden with clumps of fruiting mistletoe (J. G.). [Censuses from here on, all taken by observer on foot.]

American White Pelican	5
Northern Turkey Vulture	13
Red-bellied Red-shouldered Hawk	1
Spotted Sandpiper	1

Western Belted Kingfisher	1
Interior California Jay	1
Yellow billed Magpie	10+
Western American Crow	3
California Plain Titmouse	2
Sacramento Bewick Wren	2
Western Mexican Bluebird	20+
Pacific Audubon Warbler	1
Willow American Goldfinch	12+
Green-backed Arkansas Goldfinch	2
Oregon Junco (subsp.?)	15+

Total: species 15, individuals 89+, in 1½ hours.

Coyote Creek where crossed by highway south of Red Bluff; December 28, 1927, 8·00 a.m. to 12 m.; day with strong southeast wind and intermittent rain; distance covered, between 5 and 6 miles, along stream and over sparsely grassed prairie (see figs. 17 and 163) (J. G.).

Northern Turkey Vulture	1
Western Sparrow Hawk	6+
Interior Valley Quail	8+
North American Coot	1
Monterey Red shafted Flicker	2
Northern Black Phoebe	1
Ruddy Horned Lark	25+
American Water Pipit	3+
Western Meadow lark	60+
Savannah Sparrow	30+
Western Lark Sparrow	3
Sierra Nevada Oregon Junco	30+
Rusty Song Sparrow	1

Total: species 13, individuals 171+, in four hours.

Red Bluff, six miles north of; January 2, 1928, 10:30 a.m. to 12:30 p.m.; day with drizzly rain; distance covered, between 2 and 3 miles, over blue-oak wooded hills, with tracts of live oaks in ravines (fig. 53), and a good many digger pines on some of the low ridges (J. G.).

Sharp shinned Hawk	1
Western Red tailed Hawk	1
Monterey Red shafted Flicker	4
California Acorn storing Woodpecker	2
Nuttall Ladder-backed Woodpecker	2
Interior Valley Quail	8+
California Plain Titmouse	3
Slender billed White-breasted Nuthatch	1
Alaska Hermit Thrush	1
Western Ruby-crowned Kinglet	4
Sacramento Spotted Towhee	9
Oregon Junco (subsp. ?)	12+
Golden-crowned Sparrow	3

Total: species 13, individuals 51+, in two hours.

Dale's, 600 feet altitude; May 23, 1924, 7:00 to 8:00 a.m.; day clear; distance, about 1½ miles along Paine's Creek; riparian vegetation, cultivated fields on bottomlands, blue oaks (fig. 55) and other trees along bordering valley sides (J. G.).

Western Sparrow Hawk	1
Black-chinned Hummingbird	1
California Acorn-storing Woodpecker	3
Willow Downy Woodpecker	1
Nuttall Ladder-backed Woodpecker	1
Western Kingbird	1
Western Traill Flycatcher	2
Western Wood Pewee	3
California Plain Titmouse	1
Western House Wren	2
Western Robin	2
Russet-backed Thrush	1
Least Bell Vireo	3
Cassin Solitary Vireo	1
Western Warbling Vireo	2
California Yellow Warbler	6
Western Yellow-throat	4
Long-tailed Yellow-breasted Chat	6
California Brewer Blackbird	6
Pacific Black-headed Grosbeak	1
Lazuli Bunting	5
California Linnet	14
Willow American Goldfinch	1
Green-backed Arkansas Goldfinch	2
Modesto Song Sparrow	3

Total: species 25, individuals 73, in one hour.

Dale's, 600 feet altitude; December 26, 1924, 8:30 to 10:00 a.m.; morning bright and snappy, hoar frost on trees and ground largely snow-covered; about 3 miles traversed, circling through tracts of blue oak and buck-brush on mesa, then along riparian tracts on Paine's Creek (J. G.).

Western Red-tailed Hawk	1
Interior Valley Quail	10±
Wilson Snipe	1
Western Belted Kingfisher	1
Monterey Red-shafted Flicker	5
California Acorn-storing Woodpecker	6
Lewis Woodpecker	1
Nuttall Ladder-backed Woodpecker	1
Blue-fronted Steller Jay	16
Interior California Jay	8
California Plain Titmouse	4
Slender-billed White-breasted Nuthatch	2
Northern Rock Wren	1
Western Robin	1
Northern Varied Thrush	3

Western Mexican Bluebird	1
Western Ruby-crowned Kinglet	1
Western Meadow-lark	1
Sacramento Spotted Towhee	25±
Sacramento Brown Towhee	2
Sierra Nevada Oregon Junco	40±
Golden-crowned Sparrow	16±
Song Sparrow (subsp. ?)	2
Valdez Fox Sparrow	1

Total: species 24, individuals 150±, in 1½ hours.

Inskip Hill, 2900 to 3000 feet altitude; December 26, 1927; 11:00 a.m. to 2:00 p.m.; day clear; distance covered, between 1 and 2 miles by each of two observers, over rolling and park-like top of the hill, with open woods of yellow pine, cedar, black oak, and golden oak (J. G. and J. M. L.).

Sharp-shinned Hawk	1
Western Red-tailed Hawk	1
Interior Mountain Quail	20+
California Acorn-storing Woodpecker	2
Nuttall Ladder-backed Woodpecker	1
Blue-fronted Steller Jay	2
Interior California Jay	1
Short-tailed Mountain Chickadee	3+
California Plain Titmouse	3
Slender-billed White-breasted Nuthatch	2
Sierra Nevada Brown Creeper	3
Pallid Wren-tit	3
Western Ruby-crowned Kinglet	2
Yakutat Fox Sparrow	1

Total: species 14, individuals 45+, in three hours.

Inskip Hill, plains to eastward, about 2000 feet altitude; December 22, 1927, 8 a.m. to 12 m.; day cloudy with a little rain or sleet; distance covered about 4 miles, over plains covered with blue oaks and buck-brush (J. G.).

Sharp-shinned Hawk	1
Western Sparrow Hawk	1
Interior Valley Quail	25+
Monterey Red-shafted Flicker	6
California Acorn-storing Woodpecker	15+
Lewis Woodpecker	3
Willow Downy Woodpecker	1
Nuttall Ladder-backed Woodpecker	6+
Blue-fronted Steller Jay	6+
Interior California Jay	8+
California Plain Titmouse	15+
Slender-billed White-breasted Nuthatch	7+
Sacramento Bewick Wren	4
Western Mexican Bluebird	12+
Western Ruby-crowned Kinglet	3
California Purple Finch	15+

Sacramento Spotted Towhee	20+
Sierra Nevada Oregon Junco	10+
Golden-crowned Sparrow.	10+

Total: species 19, individuals 158+, in four hours.

Lassen highway at 3500 feet altitude; December 24, 1927, 2:00 to 2:45 p.m.; snow falling heavily; distance covered, about one mile, through open yellow pine forest with a few black oaks and cedars; old snow in patches but most of the ground bare (J.G.).

Monterey Red-shafted Flicker	1
California Acorn storing Woodpecker	2
Blue-fronted Steller Jay	1
Short-tailed Mountain Chickadee	1
California Plain Titmouse	1
Slender-billed White-breasted Nuthatch	1
Western Mexican Bluebird	15+
Oregon Junco (subsp.?)	20+

Total: species 8, individuals 42+, in ¾ hour.

Mineral, 4900 feet altitude; May 16, 1924, 7:40 to 9:20 a.m.; day clear; distance about 2 miles, east across level country of upper Battle Creek Meadows (figs. 64 to 67); through fir woods, past patches of deer brush, along willow thickets just coming into leaf, cottonwoods, and meadow creeks (J. G.).

Interior Mountain Quail	2
Calliope Hummingbird	2
Modoc Hairy Woodpecker	4
Wright Flycatcher	12
Western Wood Pewee	6
Greater Olive sided Flycatcher	1
Short tailed Mountain Chickadee	13
Red-breasted Nuthatch	6
Western Robin	3
Sierra Hermit Thrush	2
Western Ruby-crowned Kinglet	8
Cassin Solitary Vireo	6
Western Warbling Vireo	7
California Yellow Warbler	6
Pacific Audubon Warbler	3
Hermit Warbler	6
Tolmie Warbler	3
Golden Pileolated Warbler	11
Western Tanager	6
Cassin Purple Finch	5
Green-tailed Towhee	5
Sierra Nevada Oregon Junco	5
Pacific Chipping Sparrow	13
Northeastern Lincoln Sparrow.	4
Modesto Song Sparrow	5
Yosemite Fox Sparrow	2

Total: species 26, individuals 146, in 1⅔ hours.

Mineral and vicinity, 4900 to 6500 feet altitude; May 20, 1927, 8 :40 to 10 :40 a.m.; day overcast, with frequent snow squalls, but snow not lying; distance 5 miles, up road toward Viola; through woods of yellow pine, incense cedar, sugar pine, and white fir, and then into Canadian-zone chaparral (J. G.).

American Goshawk	1
Monterey Red-shafted Flicker	1
Sierra Nevada Red breasted Sapsucker	1
Northern White headed Woodpecker	4
Hammond Flycatcher	1
Wright Flycatcher	1
Blue fronted Steller Jay	5
Short tailed Mountain Chickadee	2
Red breasted Nuthatch	3
Sierra Nevada Brown Creeper	1
Western Robin	2
Townsend Solitaire	4
Western Ruby crowned Kinglet	1
Western Warbling Vireo	2
Pacific Audubon Warbler	1
Hermit Warbler	3
Tolmie Warbler	1
Golden Pileolated Warbler	1
Pacific Black headed Grosbeak	2
California Purple Finch	1
Cassin Purple Finch	1
Sierra Nevada Oregon Junco	3
Yosemite Fox Sparrow	1

Total. species 23, individuals 43, in two hours.

Mineral along north margin of Battle Creek Meadows to old wooden bridge at west end of latter, 4800 to 4900 feet altitude; June 23, 1925, 8 :15 to 9 :45 a.m.; day clear; distance traversed, 2½ miles, through woods of yellow pine, incense cedar, and white fir (fig. 65), and along pastured meadows with tracts of willow in them and lodgepole pines at their edges (fig. 66) (J. G.)

Northern Turkey Vulture	2
Northern Killdeer	2
Spotted Sandpiper	2
Modoc Hairy Woodpecker	2
Northern White headed Woodpecker	2
Western Traill Flycatcher	1
Wright Flycatcher	2
Western Wood Pewee	13
Greater Olive sided Flycatcher	1
Blue fronted Steller Jay	1
Short tailed Mountain Chickadee	2
Red breasted Nuthatch	1
Northern Pigmy Nuthatch	2
Sierra Nevada Brown Creeper	1
Western Robin	29+
Western Mexican Bluebird.	2

Townsend Solitaire	1
Western Ruby-crowned Kinglet	2
Cassin Solitary Vireo	1
Western Warbling Vireo	8
Calaveras Nashville Warbler	1
California Yellow Warbler	2
Pacific Audubon Warbler	7
Hermit Warbler	3
Tolmie Warbler	1
Golden Pileolated Warbler	1
Western Meadow-lark	2
Nevada Red-winged Blackbird	1+
California Brewer Blackbird	1
Western Tanager	5
Lazuli Bunting	3
California Purple Finch	4
Cassin Purple Finch	2
Northern Pine Siskin	1
Bendire Red Crossbill	1
Western Lark Sparrow	1
Pacific Chipping Sparrow	18
Yosemite Fox Sparrow	2

Total: species 38, individuals 133+, in 1½ hours.

Mineral across upper parts of Battle Creek Meadows, 4900 to 5000 feet altitude; July 31, 1925, 8:00 a.m. to 12 m.; weather clear, warm; distance, approximately 7 miles, across meadows, willow bogs, tracts of lodgepole pine, along stream-side growths (fig. 15) and through Transition-zone woods (J. G. and H. W. G.).

Unknown (young birds)	7
Western Red-tailed Hawk	6
Sierra Dusky Grouse	1
Calliope Hummingbird	1
Monterey Red-shafted Flicker	7
Lewis Woodpecker	4
Northern White-headed Woodpecker	1
Western Traill Flycatcher	7
Hammond Flycatcher	2
Wright Flycatcher	2
Western Wood Pewee	24
Blue-fronted Steller Jay	3
Short-tailed Mountain Chickadee	14
Red-breasted Nuthatch	3
Sierra Nevada Brown Creeper	1
Western Robin	24
Western Warbling Vireo	3
California Yellow Warbler	2
Pacific Audubon Warbler	7
Tolmie Warbler	3
California Brewer Blackbird	3
Western Tanager	28
Lazuli Bunting	7

California Purple Finch	1
Northern Pine Siskin	6
Green-backed Arkansas Goldfinch	1
Bendire Red Crossbill	2
Sierra Nevada Oregon Junco	13
Pacific Chipping Sparrow	19
Northeastern Lincoln Sparrow	3
Modesto Song Sparrow	5
Yosemite Fox Sparrow	1

Total: species 31, individuals 211, in 4 hours.

Mineral along Viola trail to upper slope of Broke-off Mountain, 5000 to 8500 feet altitude; June 17, 1925, 7:00 a.m. to 12:00 m.; day nearly clear, warm; distance covered, a little over eight miles, from Transition up through Hudsonian life-zones, deep snow in banks at uppermost level (J. G.).

Interior Mountain Quail	3
Monterey Red-shafted Flicker	2
Northern White-headed Woodpecker	1
Wright and Hammond Flycatchers	37
Western Wood Pewee	7
Greater Olive-sided Flycatcher	7
Clark Nutcracker	5
Short-tailed Mountain Chickadee	15
Red-breasted Nuthatch	9
Sierra Nevada Brown Creeper	2
Northern Rock Wren	1
Western Robin	6
Sierra Hermit Thrush	8
Townsend Solitaire	4
Western Ruby-crowned Kinglet	14
Cassin Solitary Vireo	3
Western Warbling Vireo	9
Lutescent Orange-crowned Warbler	2
California Yellow Warbler	2
Pacific Audubon Warbler	19
Hermit Warbler	6
Tolmie Warbler	8
Golden Pileolated Warbler	4
Western Tanager	7
Pacific Black-headed Grosbeak	1
Pacific Evening Grosbeak	2
Cassin Purple Finch	10
Northern Pine Siskin	3
Sierra Nevada Oregon Junco	8
Pacific Chipping Sparrow	2
Yosemite Fox Sparrow	26

Total: species 31, individuals 233, in five hours.

Mineral and vicinity, 4900 to 6400 feet altitude; December 20, 1927, 8:00 a.m. to 4:30 p.m.; day clear and no wind; distance about 8 miles, up Viola trail, on ridge next east of Martin Creek, to about

6400 feet, then south down east side of that ridge to Battle Creek, and down that to highway; snow on open, level ground to depth of about 18 inches (J. G.).

Honker Canada Goose	8
Pacific Williamson Sapsucker	1
Modoc Hairy Woodpecker	1+
Northern White-headed Woodpecker	3
Blue-fronted Steller Jay	1
Short-tailed Mountain Chickadee	15+
Sierra Nevada Brown Creeper	3
Golden-crowned Kinglet	16+
Western Mexican Bluebird	3+

Total: species 9, individuals 51+, in 8½ hours.

Morgan, ranch to hot springs and return; December 21, 1927, 9:30 to 11:30 a.m.; day partly cloudy; distance covered, about 3 miles, over trail and through ten inches of soft snow (J. G.).

Monterey Red-shafted Flicker	1
Western Pileated Woodpecker	1
Modoc Hairy Woodpecker	1
Blue-fronted Steller Jay	1
Short-tailed Mountain Chickadee	2
Red-breasted Nuthatch	1
Sierra Nevada Brown Creeper	1

Total: species 7, individuals 8, in two hours.

Kelly's, 5200 feet altitude; September 2, 1925, 7:00 to 8:00 a.m.; day clear at first, then cloudy; distance about 2 miles along a trail, mostly through rather open coniferous forest (H. S. S.).

Cooper Hawk (family)	4
Sierra Nevada Red-breasted Sapsucker	1
Modoc Hairy Woodpecker	3
Northern White-headed Woodpecker	3
Yellow-bellied Western Flycatcher	1
Western Wood Pewee	1
Blue-fronted Steller Jay	4
Clark Nutcracker	4
Short-tailed Mountain Chickadee	4
Red-breasted Nuthatch	4
Sierra Nevada Brown Creeper	1
Western Robin	3
Townsend Solitaire	2
Cassin Solitary Vireo	1
Pacific Audubon Warbler	1
Golden Pileolated Warbler	1
Western Tanager	1
Pacific Evening Grosbeak	20+
Cassin Purple Finch	3
Sierra Nevada Oregon Junco	15+
Yosemite Fox Sparrow	2

Total: species 21, individuals 79+, in one hour.

Lassen Peak, from 7300 feet altitude on Upper Kings Creek Meadows to summit, 10,451 feet; July 26, 1929, 7:20 a.m. to 12:10 p.m.; day perfectly clear, warm; distance traversed, approximately 6 miles along Drakesbad trail; across and along Canadian-zone meadows (fig. 24) and, first two hours, up through woods of red fir and mountain hemlock (J. G.).

Swainson Hawk	2
Spotted Sandpiper	2
Modoc Hairy Woodpecker	1
Arctic Three toed Woodpecker	1
Western Wood Pewee	7
Clark Nutcracker	13
Short tailed Mountain Chickadee	7
Red breasted Nuthatch	4
Northern Rock Wren	2
Western Robin	5
Townsend Solitaire	1
Golden crowned Kinglet	7+
Western Ruby crowned Kinglet	2
Pacific Audubon Warbler	9
Western Tanager	1
Cassin Purple Finch	17
Northern Pine Siskin	2
Sierra Nevada Oregon Junco	30
Pacific Chipping Sparrow	5
Hudsonian White crowned Sparrow	3
Northeastern Lincoln Sparrow	2

Total species 21, individuals 123+, in 4⅚ hours (but only 4 birds seen in last 2⅚ hours).

Prospect Peak, from Butte Lake, 6100 feet altitude, to summit, 8340 feet, June 28, 1928, 8:30 to 11:40 a.m.; sky clear at first, latterly overcast with thunderclouds, distance by trail, about 6 miles, through Transition- and Canadian-zone woods, latter of red fir and silver pine with some carpeting of pine-mat manzanita and other low shrubs (J. G.)

Calliope Hummingbird	2
Monterey Red shafted Flicker	3
Western Pileated Woodpecker	1
Pacific Williamson Sapsucker	1
Hammond Flycatcher	7
Western Wood Pewee	5
Greater Olive sided Flycatcher	3
Blue fronted Steller Jay	1
Clark Nutcracker	5
Short tailed Mountain Chickadee	8
Rocky Mountain White breasted Nuthatch	3
Red breasted Nuthatch	5
Northern Rock Wren	1
Western Robin	4
Sierra Hermit Thrush	1

Townsend Solitaire	2
Western Ruby-crowned Kinglet	7
Pacific Audubon Warbler	14
Tolmie Warbler	1
Western Tanager	10
Pacific Evening Grosbeak	1
Cassin Purple Finch	21
Pacific Chipping Sparrow	3
Yosemite Fox Sparrow	4

Total: species 24, individuals 113, in 3⅙ hours.

Ravendale, 8 miles southwest of; July 18, 1928, 6:00 to 11:00 a.m.; day clear and warm; distance about 10 miles; through sage-brush and scattered juniper over rocky southeast slope of mountain (J. M. L.).

Northern Turkey Vulture	1
Golden Eagle	1
Western Sparrow Hawk	4
Sage Hen	2
Western Mourning Dove	7
Monterey Red-shafted Flicker	7
Northern Ash-throated Flycatcher	9
Interior California Jay	21
Short-tailed Mountain Chickadee	13
Gray Plain Titmouse	7
Lead-colored Bush-tit	28+
Sacramento Bewick Wren	4
Northern Rock Wren	34
Black-throated Gray Warbler	13
Western Meadow-lark	1
California Brewer Blackbird	1
California Linnet	3
Green-tailed Towhee	18
Pacific Chipping Sparrow	10
Brewer Sparrow	27

Total: species 20, individuals 216+, in five hours.

Dransfield's, 5300 feet altitude; January 3, 1926, 4 hours in morning; snow falling during part of morning; distance 2 miles toward Observation Peak through sage-brush (A. E. B.).

American Rough-legged Hawk	2
Wilson Snipe	1
American Black-billed Magpie	1

Total: species 3, individuals 4, in four hours.

One definite areal census was taken in the section—one-half mile east of Mineral on a measured and staked-off tract of very close to 6½ acres extent immediately adjoining the Forest Service camp ground, on the west of it. Close proximity of this tract to our camp (J. G. and H. W. G.) made it possible to search it repeatedly at all hours of the day and day after day, at the height of the breeding season, with the result that not only "singing posts" of males were located but in nearly every case the nest itself, so that the "focus of interest" of each pair of breeding birds could be figured out and plotted on the working map we kept of the tract.

The tract in question is gently sloping toward the south. There is no water on it (no meadow or riparian vegetation represented at all on it); but a spring 100 yards east of the eastern boundary and a willow bog 200 yards south mean ready access to water by birds that require its use for drinking or bathing. The vegetation of the tract is mixed conifers and chaparral, the latter predominating and consisting almost solely of snow-brush (fig. 35), so rich for bird subsistence, though there are a few bushes of red cherry, service-berry, and chinquapin (not in full vigor). The conifers are chiefly white firs, some in clumps of young growth (fig. 67), others old, tall, isolated, and scraggly, affording lofty singing posts for birds seeking such. There are also yellow pines, some young and a few large ones standing apart in the chaparral.

As a result of our concentrated study of this tract from June 12 to 28, 1925, it was determined that 24 breeding pairs of birds were established there—not quite 4 pairs of birds on an average to the acre. The species represented were 14 in number, as follows, with number of pairs of each indicated: Interior Mountain Quail 2, Wright Flycatcher 5, Western Wood Pewee 1, Greater Olive-sided Flycatcher 1, Short-tailed Mountain Chickadee 1, Western Ruby-crowned Kinglet 1, California Yellow Warbler 1, Hermit Warbler 1, Tolmie Warbler 2, Western Tanager 1, Lazuli Bunting 1, Green-tailed Towhee 2, Pacific Chipping Sparrow 3, Yosemite Fox Sparrow 2.

Of course, there were many other birds present on occasion, but as vagrants or as foragers from headquarters in adjacent territory, and so they were not considered in this count, neither were 4 Calliope Hummingbirds, males, each with a separate and rather fixed "stand" within our 6½ acres. Females of this species now and then appeared, but these females all had their nesting sites elsewhere, so that the Calliope Hummingbird, we thought, even though the males *were* attached to definite "posts," could not properly be included in the census.

Now this census of four breeding pairs of birds to the acre cannot be considered as representing the average for the entire Lassen section. Granted that it is exceeded, perhaps by double or treble, in certain tracts of luxuriant stream-side or swamp-margin vegetation, the total area of these is small in comparison with the great stretches of far less populated territory comprised in dense forest and, especially, in arid blue oak and sage-brush territory. Appealing to our "time" censuses, examples of which are given on preceding pages, and also appealing to memory impressions of the bird life along the many routes traversed, our conclusion is that for the entire Lassen section the population averages not more than one breeding pair of birds to the acre. Even this would make an early-summer population of 3,810,000 individual birds within the section, and this would be doubled with the twofold expansion incident to appearance of the young-of-the-year.

With the single exact areal census above recorded, it might be possible to evaluate on an areal basis the *time* censuses we took, by establishing figures per acre through comparing the acre results with the time results over the same type of territory. An approximate set of counts would be obtained, but, we think, their value *for comparisons* of populations could be no greater than the original census figures. On the basis of these latter, then, plus our general knowledge of the section through accumulating impressions, we offer the following general conclusions.

The densest bird population in summer obtains in the riparian tracts along the Sacramento River, where maximum warmth and ground moisture are both present. The poorest territory, avifaunally, is that comprised in the barren upper slopes of Lassen Peak and that on the arid prairie-land of the Sacramento Valley and lower piedmont slope. In winter, the bird population is most abundant at the west end of the section, in the territory designated as Upper and Lower Sonoran life-zones. While in summer the sage-brush habitat of the Great Basin Upper Sonoran possesses more birds than the non-riparian habitats making up the Upper Sonoran on the western piedmont, winter witnesses a sharp reversal of this condition.

The life-zone above the Lower Sonoran richest in summer bird life is the Canadian. Next comes Upper Sonoran, then Transition, then Hudsonian, while Arctic-Alpine is a blank save for vagrants.

The number of species in any part of the Lassen section is small compared with what obtains in the whole section. The number in the whole section is small compared with what obtains in many other sections of like area in the United States. Over most of the Lassen area, the individuals of each species are scattered, fewer in number than in most parts of the United States. It is only the concentration of numbers in the relatively few favorable places in the Lassen section that brings the total population up to near the mean figures for the whole United States, two birds per acre in the nesting season.

Reasons for the smallness of censuses at the seasons of migration are as follows: The position of the Lassen region, by topography and geography, is outside any major flight line; the mountainous condition of the terrain plus the generally low rainfall in spring and fall make for restriction of moist ground such as provides food at those seasons to attract and hold migrants. On the other hand, the mild winter temperature and the occurrence of the rains at that season account for the abundant population of winter-resident species at the lower western end of the section, in the "California Faunal Area."

In the light of the above considerations it may be suggested, for bionomics, that where individuals of a given species are sparsely distributed, the habitat for that species greatly interrupted, as in the Lassen region, the chances for developing and perpetuating local population strains are better than in an area of contrary nature; there is more of a chance for sequestration of stocks within short linear distance and therefore more "materials" for the processes of speciation to work upon. Coincidentally, in a territory like the Lassen section where there is a multiplicity of habitats, in several life-zones and in several faunal divisions of these, there is greater range of choice of habitat for the various ecologic types of animals there, hence more likelihood of interaction. The mammals and the reptiles, as well as the birds, give plenteous seemingly good cases in illustration of these principles.

HISTORICAL COMMENT

The first formal and definite ascription of any vertebrate species to the Lassen Peak region was by Dr. J. S. Newberry (1857), who was a member of one of the Pacific Railroad Survey parties. He barely entered the territory included in our section from Fort Reading (July 28, 1855), Shasta County, proceeding *via* Shingletown and McCumber's Flat (July 29), on Battle Creek, thence through Noble's Pass (July 30), up Lost Creek, and then down Hat Creek (July 31), and on toward Pit River. Newberry's statements concerning the birds and mammals encountered in northern California and Oregon are mostly of general regional application, but he definitely comments upon the Grizzly Bear, Clarke's Crow, Lewis' Woodpecker, and Mountain Quail (using his vernacular names) as being noted in the vicinity of "Lassen's butte."

The next scientific report concerning the animal life of the region under consideration was that by Henry W. Henshaw (1879) on the birds of portions of western Nevada, northeastern California, and Oregon. His explorations under the Wheeler Surveys within the territory of our section occupied small parts of the periods between June 6 and October 1, 1877, and July 18 and October 1, 1878. The exact places and dates of his collecting within our territory are not stated, but scrutiny of his published list of birds shows that he was at Eagle Lake at least on July 4 and 10, 1877. Seven species are definitely recorded from there, and a great number of general statements doubtless cover his observations there as well as elsewhere. It is a pity that more detailed records of the conditions in their times were not left by Henshaw and Newberry.

The third and up to the present time the most important published account of the vertebrate life of the Lassen region was that by Dr. Charles H. Townsend (1887). This was based on his own field work in several parts of northern California. As learned from his published report and from the original manuscript register of specimens which he has kindly allowed us to consult, Dr. Townsend collected at and around Red Bluff, December 18 to 25, 1883, and March 11 to May 25, 1884, and in the "region sloping eastward from Lassen's Peak," May 26 to July 20, 1884. During this latter period he was at Eagle Lake, June 27 to 29, inclusive.

In 1905, Harry H. Sheldon (1907) with two companions visited Eagle Lake and collected specimens of birds and birds' eggs there, chiefly at the southwest end and along the northwestern side, from June 26 to at least August 4. His long list of birds as published gives much valuable data and pertains to a time when the lake level was somewhere near its highest, and when the extensive bordering tule beds and the stump forest provided subsistence for an extraordinarily large avian population, to judge from his description.

Aside from the above-mentioned four contributions, each of special importance to the main purposes of our present paper, there have been a number of minor published articles or notes pertaining to the natural history of the Lassen region. The titles of these are included under the heading, Literature Cited (pp. 579–582).

CHECK-LIST OF THE TERRESTRIAL VERTEBRATES OF THE LASSEN SECTION

Amphibia

Triturus torosus (Eschscholtz)
Ambystoma macrodactylum Baird
Ensatina sierrae Storer
Scaphiopus hammondii Baird
Bufo boreas boreas Baird and Girard
Bufo boreas halophilus Baird and Girard
Hyla regilla Baird and Girard
Rana aurora draytonii Baird and Girard
Rana boylii boylii Baird
Rana boylii sierrae Camp
Rana pretiosa pretiosa Baird and Girard

Reptilia

Uta stansburiana stansburiana Baird and Girard
Sceloporus graciosus gracilis Baird and Girard
Sceloporus occidentalis occidentalis Baird and Girard
Gerrhonotus palmeri (Stejneger)
Gerrhonotus scincicauda scincicauda (Skilton)
Cnemidophorus tesselatus mundus Camp
Eumeces skiltonianus (Baird and Girard)
Charina bottae (Blainville)
Coluber constrictor mormon Baird and Girard
Coluber lateralis (Hallowell)
Pituophis catenifer deserticola Stejneger
Pituophis catenifer heermanni (Hallowell)
Lampropeltis getulus boylii (Baird and Girard)
Contia tenuis (Baird and Girard)
Thamnophis ordinoides atratus (Kennicott)
Thamnophis ordinoides couchii (Kennicott)
Thamnophis ordinoides elegans (Baird and Girard)
Thamnophis sirtalis infernalis (Blainville)
Crotalus oreganus Holbrook
Clemmys marmorata (Baird and Girard)

Aves

Gavia immer (Brünnich)
Colymbus nigricollis californicus (Heermann)
Aechmophorus occidentalis (Lawrence)
Podilymbus podiceps podiceps (Linnaeus)
Pelecanus erythrorhynchos Gmelin
Phalacrocorax auritus albociliatus Ridgway
Ardea herodias hyperonca Oberholser
Butorides virescens anthonyi (Mearns)
Nycticorax nycticorax naevius (Boddaert)
Botaurus lentiginosus (Montagu)
Plegadis guarauna (Linnaeus)
Cygnus columbianus (Ord)
Branta canadensis canadensis (Linnaeus)
Branta canadensis minima Ridgway
Anser albifrons albifrons (Scopoli)
Chen hyperboreus hyperboreus (Pallas)
Anas platyrhynchos platyrhynchos Linnaeus
Chaulelasmus streperus (Linnaeus)
Mareca americana (Gmelin)
Dafila acuta tzitzihoa (Vieillot)
Nettion carolinense (Gmelin)
Querquedula discors (Linnaeus)
Querquedula cyanoptera (Vieillot)

Spatula clypeata (Linnaeus)
Aix sponsa (Linnaeus)
Nyroca affinis (Eyton)
Nyroca collaris (Donovan)
Nyroca americana (Eyton)
Nyroca valisineria (Wilson)
Glaucionetta islandica (Gmelin)
Charitonetta albeola (Linnaeus)
Erismatura jamaicensis rubida (Wilson)
Mergus americanus Cassin
Cathartes aura septentrionalis Wied
Gymnogyps californianus (Shaw)
Elanus leucurus majusculus Bangs and Penard
Astur atricapillus (Wilson)
Accipiter velox (Wilson)
Accipiter cooperii (Bonaparte)
Buteo borealis calurus Cassin
Buteo lineatus elegans Cassin
Buteo swainsoni Bonaparte
Buteo lagopus sancti-johannis (Gmelin)
Buteo regalis (Gray)
Aquila chrysaëtos (Linnaeus)
Haliaeëtus leucocephalus leucocephalus (Linnaeus)
Circus hudsonius (Linnaeus)
Pandion haliaëtus carolinensis (Gmelin)
Falco mexicanus Schlegel
Falco peregrinus anatum Bonaparte
Falco columbarius richardsonii Ridgway
Falco columbarius bendirei Swann
Falco sparverius phalaena (Lesson)
Dendragapus obscurus sierrae Chapman
Centrocercus urophasianus (Bonaparte)
Lophortyx californica vallicola (Ridgway)
Oreortyx picta picta (Douglas)
Grus canadensis tabida (Peters)
Rallus virginianus pacificus Dickey
Porzana carolina (Linnaeus)
Fulica americana americana Gmelin
Oxyechus vociferus vociferus (Linnaeus)
Capella delicata (Ord)
Numenius americanus Bechstein
Actitis macularia (Linnaeus)
Tringa solitaria cinnamomea (Brewster)
Catoptrophorus semipalmatus inornatus (Brewster)
Totanus melanoleucus (Gmelin)
Pisobia bairdii (Coues)
Pisobia minutilla (Vieillot)
Limnodromus griseus scolopaceus (Say)
Pelidna alpina sakhalina (Vieillot)
Ereunetes mauri Cabanis
Recurvirostra americana Gmelin
Steganopus tricolor Vieillot
Lobipes lobatus (Linnaeus)
Larus californicus Lawrence
Larus delawarensis Ord
Sterna forsteri Nuttall
Hydroprogne caspia imperator (Coues)
Chlidonias nigra surinamensis (Gmelin)
Columba fasciata fasciata Say
Zenaidura macroura marginella (Woodhouse)
Geococcyx californianus (Lesson)
Tyto alba pratincola (Bonaparte)
Otus asio quercinus Grinnell
Bubo virginianus pacificus Cassin
Bubo virginianus occidentalis Stone
Glaucidium gnoma californicum Sclater
Speotyto cunicularia hypugaea (Bonaparte)
Strix occidentalis occidentalis (Xantus)
Asio wilsonianus (Lesson)
Asio flammeus flammeus (Pontoppidan)
Phalaenoptilus nuttallii californicus Ridgway
Chordeiles minor hesperis Grinnell
Chordeiles acutipennis texensis Lawrence
Chaetura vauxii (J. K. Townsend)
Aëronautes saxatilis saxatilis (Woodhouse)
Archilochus alexandri (Bourcier and Mulsant)
Calypte anna (Lesson)
Selasphorus rufus (Gmelin)
Stellula calliope (Gould)
Megaceryle alcyon caurina (Grinnell)

Colaptes cafer collaris Vigors
Ceophloeus pileatus picinus (Bangs)
Balanosphyra formicivora bairdi (Ridgway)
Asyndesmus lewisi Riley
Sphyrapicus varius nuchalis Baird
Sphyrapicus varius daggetti Grinnell
Sphyrapicus thyroideus thyroideus (Cassin)
Dryobates villosus orius Oberholser
Dryobates pubescens turati (Malherbe)
Dryobates pubescens leucurus (Hartlaub)
Dryobates nuttallii (Gambel)
Xenopicus albolarvatus albolarvatus (Cassin)
Picoides arcticus (Swainson)
Tyrannus verticalis Say
Myiarchus cinerascens cinerascens (Lawrence)
Sayornis saya saya (Bonaparte)
Sayornis saya yukonensis Bishop
Sayornis nigricans semiatra (Vigors)
Empidonax traillii brewsteri Oberholser
Empidonax hammondii (Xantus)
Empidonax wrightii Baird
Empidonax griseus Brewster
Empidonax difficilis difficilis Baird
Myiochanes virens richardsonii (Swainson)
Nuttallornis mesoleucus majorinus Bangs and Penard
Otocoris alpestris rubea Henshaw
Otocoris alpestris merrilli Dwight
Tachycineta thalassina lepida Mearns
Iridoprocne bicolor (Vieillot)
Stelgidopteryx ruficollis serripennis (Audubon)
Hirundo rustica erythrogaster Boddaert
Petrochelidon albifrons albifrons (Rafinesque)
Progne subis subis (Linnaeus)
Cyanocitta stelleri frontalis (Ridgway)
Aphelocoma californica immanis Grinnell
Pica pica hudsonia (Sabine)
Pica nuttallii (Audubon)
Corvus corax sinuatus Wagler
Corvus brachyrhynchos hesperis Ridgway
Cyanocephalus cyanocephalus (Wied)
Nucifraga columbiana (Wilson)
Penthestes gambeli abbreviatus Grinnell
Baeolophus inornatus inornatus (Gambel)
Baeolophus inornatus griseus (Ridgway)
Psaltriparus minimus californicus Ridgway
Psaltriparus minimus plumbeus (Baird)
Sitta carolinensis aculeata Cassin
Sitta carolinensis nelsoni Mearns
Sitta canadensis Linnaeus
Sitta pygmaea pygmaea Vigors
Certhia familiaris zelotes Osgood
Chamaea fasciata henshawi Ridgway
Cinclus mexicanus unicolor Bonaparte
Troglodytes aëdon parkmanii Audubon
Nannus hiemalis pacificus (Baird)
Thryomanes bewickii drymoecus Oberholser
Telmatodytes palustris plesius (Oberholser)
Catherpes mexicanus punctulatus Ridgway
Catherpes mexicanus conspersus Ridgway
Salpinctes obsoletus obsoletus (Say)
Mimus polyglottos leucopterus (Vigors)
Toxostoma redivivum sonomae Grinnell
Oroscoptes montanus (J.K.Townsend)
Turdus migratorius propinquus Ridgway
Ixoreus naevius naevius (Gmelin)
Ixoreus naevius meruloides (Swainson)
Hylocichla guttata guttata (Pallas)
Hylocichla guttata sequoiensis (Belding)
Hylocichla ustulata ustulata (Nuttall)
Sialia mexicana occidentalis J. K. Townsend
Sialia currucoides (Bechstein)

Myadestes townsendi (Audubon)
Polioptila caerulea amoenissima Grinnell
Regulus satrapa olivaceus Baird
Corthylio calendula cineraceus (Grinnell)
Anthus spinoletta rubescens (Tunstall)
Bombycilla cedrorum Vieillot
Phainopepla nitens lepida Van Tyne
Lanius borealis invictus Grinnell
Lanius ludovicianus gambeli Ridgway
Vireo bellii pusillus Coues
Vireo solitarius cassinii Xantus
Vireo gilvus swainsonii Baird
Vermivora ruficapilla gutturalis (Ridgway)
Vermivora celata lutescens (Ridgway)
Dendroica aestiva brewsteri Grinnell
Dendroica coronata hooveri McGregor
Dendroica auduboni auduboni (J. K. Townsend)
Dendroica nigrescens (J.K.Townsend)
Dendroica townsendi (J.K.Townsend)
Dendroica occidentalis (J. K. Townsend)
Oporornis tolmiei (J. K. Townsend)
Geothlypis trichas occidentalis Brewster
Icteria virens longicauda Lawrence
Wilsonia pusilla pileolata (Pallas)
Wilsonia pusilla chryseola Ridgway
Sturnella neglecta Audubon
Xanthocephalus xanthocephalus (Bonaparte)
Agelaius phoeniceus nevadensis Grinnell
Agelaius phoeniceus californicus Nelson
Agelaius tricolor (Audubon)
Icterus bullockii (Swainson)
Euphagus cyanocephalus minusculus Grinnell
Piranga ludoviciana (Wilson)
Zamelodia melanocephala capitalis (Baird)
Guiraca caerulea salicarius Grinnell
Passerina amoena (Say)
Passer domesticus domesticus (Linnaeus)
Hesperiphona vespertina brooksi Grinnell
Carpodacus purpureus californicus Baird
Carpodacus cassinii Baird
Carpodacus mexicanus frontalis (Say)
Acanthis linaria linaria (Linnaeus)
Spinus pinus pinus (Wilson)
Spinus tristis salicamans Grinnell
Spinus psaltria hesperophilus (Oberholser)
Loxia curvirostra bendirei Ridgway
Oberholseria chlorura (Audubon)
Pipilo maculatus falcinellus Swarth
Pipilo maculatus curtatus Grinnell
Pipilo fuscus carolae McGregor
Passerculus sandwichensis sandwichensis (Gmelin)
Passerculus sandwichensis anthinus Bonaparte
Passerculus sandwichensis alaudinus Bonaparte
Passerculus sandwichensis nevadensis Grinnell
Ammodramus savannarum bimaculatus Swainson
Pooecetes gramineus confinis Baird
Pooecetes gramineus affinis G. S. Miller
Chondestes grammacus strigatus Swainson
Amphispiza belli nevadensis (Ridgway)
Amphispiza bilineata deserticola Ridgway
Junco hyemalis hyemalis (Linnaeus)
Junco oreganus oreganus (J. K. Townsend)
Junco oreganus shufeldti Coale
Junco oreganus thurberi Anthony
Spizella passerina stridula Grinnell
Spizella breweri Cassin
Zonotrichia coronata (Pallas)
Zonotrichia leucophrys leucophrys (J. R. Forster)
Zonotrichia leucophrys gambelii (Nuttall)
Zonotrichia leucophrys pugetensis Grinnell
Passerella lincolnii lincolnii (Audubon)
Passerella melodia mailliardi (Grinnell)

Passerella melodia fisherella (Oberholser)
Passerella melodia merrilli (Brewster)
Passerella melodia morphna (Oberholser)
Passerella iliaca altivagans Riley
Passerella iliaca schistacea Baird
Passerella iliaca fulva Swarth
Passerella iliaca mariposae Swarth
Passerella iliaca megarhynchus Baird
Passerella iliaca annectens Ridgway
Passerella iliaca sinuosa Grinnell
Passerella iliaca unalaschcensis (Gmelin)

Mammalia

Scapanus latimanus latimanus (Bachman)
Scapanus latimanus dilatus True
Neürotrichus gibbsii gibbsii (Baird)
Sorex trowbridgii mariposae Grinnell
Sorex vagrans amoenus Merriam
Sorex ornatus californicus Merriam
Sorex palustris navigator (Baird)
Myotis lucifugus carissima Thomas
Myotis yumanensis sociabilis H. W. Grinnell
Myotis evotis chrysonotus (J. A. Allen)
Myotis volans interior Miller
Myotis californicus californicus (Audubon and Bachman)
Myotis subulatus melanorhinus (Merriam)
Lasionycteris noctivagans (LeConte)
Pipistrellus hesperus merriami (Dobson)
Eptesicus fuscus fuscus (Peale and Beauvois)
Nycteris borealis teliotis (H. Allen)
Corynorhinus rafinesquii intermedius H. W. Grinnell
Antrozous pallidus pacificus Merriam
Tadarida mexicana (Saussure)
Ursus americanus californiensis J. Miller
Ursus klamathensis Merriam
Procyon lotor psora Gray
Bassariscus astutus raptor (Baird)
Martes caurina sierrae Grinnell and Storer
Martes pennanti pacifica (Rhoads)
Mustela muricus (Bangs)
Mustela arizonensis (Mearns)
Mustela vison energumenos (Bangs)
Lutra canadensis brevipilosus Grinnell
Spilogale gracilis saxatilis Merriam
Spilogale phenax phenax Merriam
Mephitis occidentalis occidentalis Baird
Mephitis occidentalis major (Howell)
Taxidea taxus neglecta Mearns
Vulpes fulva necator Merriam
Urocyon cinereoargenteus californicus Mearns
Canis lestes Merriam
Felis oregonensis californica May
Lynx rufus californicus Mearns
Lynx rufus pallescens Merriam
Marmota flaviventer flaviventer (Audubon and Bachman)
Otospermophilus douglasii (Richardson)
Callospermophilus chrysodeirus chrysodeirus (Merriam)
Citellus oregonus (Merriam)
Eutamias minimus pictus (Allen)
Eutamias amoenus amoenus (Allen)
Eutamias speciosus frater (Allen)
Eutamias senex (Allen)
Sciurus douglasii albolimbatus Allen
Sciurus griseus griseus Ord
Glaucomys sabrinus lascivus (Bangs)
Thomomys bottae leucodon Merriam
Thomomys bottae navus Merriam
Thomomys quadratus quadratus Merriam
Thomomys monticola monticola Allen
Perognathus parvus mollipilosus Coues
Dipodomys heermanni californicus Merriam
Dipodomys heermanni saxatilis Grinnell and Linsdale
Dipodomys ordii columbianus (Merriam)
Microdipodops megacephalus oregonus Merriam
Onychomys leucogaster fuscogriseus Anthony

Reithrodontomys megalotis megalotis (Baird)
Reithrodontomys megalotis longicaudus (Baird)
Peromyscus crinitus crinitus (Merriam)
Peromyscus maniculatus gambelii (Baird)
Peromyscus boylii boylii (Baird)
Peromyscus truei truei (Shufeldt)
Peromyscus truei gilberti (Allen)
Neotoma intermedia nevadensis Taylor
Neotoma fuscipes streatori Merriam
Neotoma cinerea occidentalis Baird
Evotomys mazama Merriam
Microtus montanus yosemite Grinnell
Microtus californicus eximius R. Kellogg
Microtus mordax mordax (Merriam)
Microtus mordax sierrae R. Kellogg
Ondatra zibethica mergens (Hollister)
Rattus rattus alexandrinus (Geoffroy-Saint Hilaire and Audouin)
Mus musculus Linnaeus
Aplodontia rufa californica (Peters)
Zapus pacificus alleni Elliot
Erethizon epixanthum epixanthum Brandt
Ochotona schisticeps schisticeps (Merriam)
Ochotona schisticeps taylori Grinnell
Lepus townsendii townsendii Bachman
Lepus washingtonii klamathensis Merriam
Lepus californicus californicus Gray
Lepus californicus wallawalla Merriam
Sylvilagus nuttallii nuttallii (Bachman)
Sylvilagus audubonii audubonii (Baird)
Sylvilagus bachmani bachmani (Waterhouse)
Sylvilagus idahoensis (Merriam)
Odocoileus columbianus columbianus (Richardson)
Odocoileus hemionus hemionus (Rafinesque)
Odocoileus virginianus macrourus (Rafinesque)
Antilocapra americana americana (Ord)
Bison bison bison (Linnaeus)
Ovis canadensis californiana Douglas

GENERAL ACCOUNTS

Amphibians

Triturus torosus (Eschscholtz)

Pacific Coast Newt

Found in or near small streams of the Sacramento River drainage system below 3500-foot contour line. Specimens from: nine miles northeast of Red Bluff, 350 feet; Bloody Island, 350 feet; Paine's Creek at 400 feet; Dale's, 600 feet; Elliott's, 1000 feet; Turner's, 3500 feet.

At Elliott's on June 5, 1924, two newts were found under boards at the edge of a pond. The specimen from Bloody Island was picked up in the bed of a small stream from which the water had just been diverted for use in irrigation.

Eight specimens of this newt were taken from a large spring near Dale's on May 23, 1924. They were sprawled out separately on the gravelly bottom in the cold water, eight to ten inches deep, some under masses of water cress, others in plain view. The brilliant red on the bellies of these animals showed up strikingly when they were turned over, but nothing could be seen of it when they were right side up.

Of the fourteen individuals that were preserved from the spring at Dale's (fig. 13) on May 20 and 23, 1924, ten were females which contained eggs apparently nearly ready for deposition. A larval newt, fifty-three millimeters in total length, which, judging from its color, was in the first stages of transformation, was taken from the water at the edge of the pond at Elliott's on December 25, 1927.

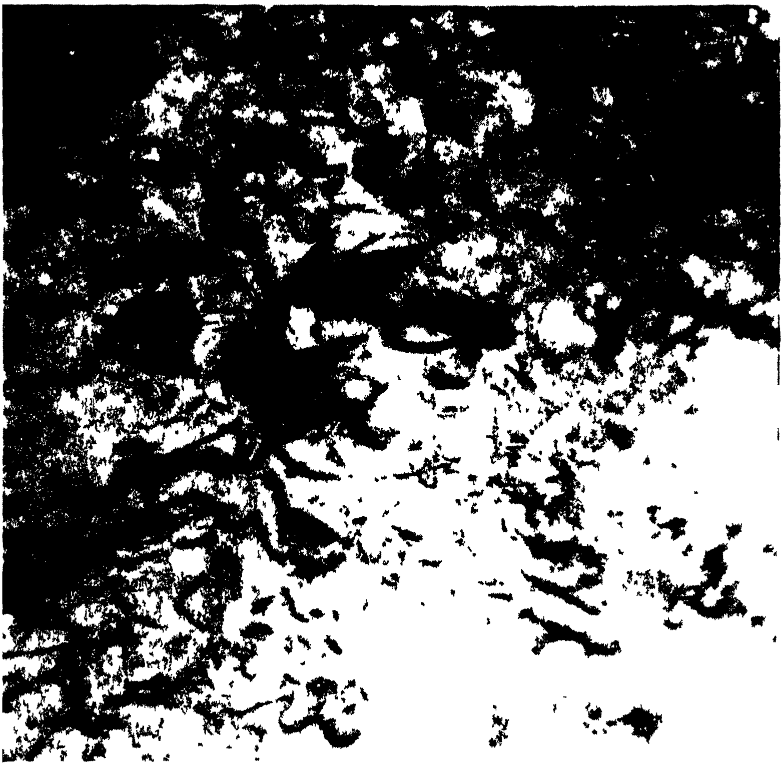


Fig. 119. Pacific coast newt (*Triturus torosus*) on bottom of pool in small stream close to Sacramento River. The dark color of the back of the animals in this situation closely matched that of sticks and leaves in the pools where they were found in spring. Photograph taken April 18, 1929, seven miles north east of Red Bluff. Mus. Vert. Zool. no. 5863.

An examination of the alimentary tracts of fourteen newts from a spring at Dale's showed that three had eaten some small bivalve molluscs (*Pisidium*), one had eaten a large insect larva and two annelid worms, and the other eleven had eaten snails (*Goniobasis*).

On April 23, 1928, a lot of forty-four newts was taken from a stream, a short tributary of the Sacramento River, where the road crosses it nine miles northeast of Red Bluff. The stream was drying rapidly; there was running water for only a short distance above where the animals were found. The pools inhabited (fig. 119) were less than half a mile from the river. The stream had cut a deep and very narrow gorge through the sandstone so that it was shaded and the walls were moist. None of the animals had been seen when this place was visited a few days previously. All the small individuals (the two smallest measured 55 and 60 millimeters in length, respectively) were crawling over the moist rocks, as were some of the adult individuals. Most of the adults were in the pools of water. Several pairs were copulating. Ovaries of the females were filled with eggs. It was thought that the animals here must have come from crevices in the rocks, since all the boards in the vicinity were dry on the under sides.

At Turner's several newts were present April 26, 1928, in a deep pool in a stream traversing a meadow. When disturbed, the animals would swim downward and hide in trash or beneath logs in the water. The newts in this pool were appreciably larger than the adults collected at stations at lower altitudes in the section. Only males were in the lot taken from this pool. Five of them measured in total length as follows: 175, 187, 190, 208, and 215 millimeters.

On December 25, 1927, a fully grown larva was taken from the pond at Elliott's. The salamander was dipped up from the water close to the rocky shore. All the observations of this species in the section support the belief that the larvae do not transform during the same summer in which the eggs are laid, but that in this vicinity they spend their first winter in the water.

Ambystoma macrodactylum Baird

Long-toed Salamander

Encountered by us at only one place in the section: Emerald Lake, near Lake Helen, 8200 feet (fig. 10), where fourteen specimens were taken from beneath logs and rocks in the edge of the lake on July 14, 1924. The individuals obtained ranged in total length from 65 to 97 millimeters. Gills were present on all, but on one or two they were reduced to small stubs.

Professor Loye Miller informs us that in late June, 1929, he found long-toed salamanders under logs in dry pine woods and in wet meadows close to Mineral and at Wilson Lake. Specimens were not preserved.

Ensatina sierrae Storer

Sierra Nevada Salamander

Found only three times: a specimen (no. 10030) taken from a log near Summit Creek, 5200 feet, June 17, 1924; two (nos. 10890–91) found near Turner's, 3500 feet, April 27 and 28, 1928. Both the individuals from Turner's were beneath rotting logs of incense cedar on shaded, moist ground close to small streams.

Scaphiopus hammondii Baird

Western Spadefoot Toad

Specimens were obtained in the neighborhood of Red Rock P. O., 5300 feet, on June 19 and July 21 to 26, 1928.

Five of the toads were picked up in the evening or early morning on the sand among sage-bushes or clumps of wild rye (fig. 28). Three were caught in traps set in meadow mouse runways at the edge of a slough in a hayfield where there was a permanent supply of water.

The series of eight specimens from the eastern part of the section can be separated into two sharply different size groups. The two largest individuals are close to 50 millimeters long. The other six are remarkably uniform in size, all near 30 millimeters in length.

Bufo boreas boreas Baird and Girard

Northwestern Toad

Found within the section at altitudes from 3500 to 8400 feet. Specimens obtained from: Turner's, 3500 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Warner Creek at 8000 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet. Seen, also, at Wilson Lake where small yearlings were numerous on May 24, 1927.

At Eagle Lake Resort on July 12, 1925, hundreds of small toads were seen (although no full-grown ones were noted), which were leaving the water and moving toward the near-by weed patches. These animals were nearly twenty-five millimeters long. Twelve small toads, which measured from 15 to 26 millimeters in total length, were taken from Warner Creek at 8000 feet on September 17, 1923. An individual, 28 millimeters long, which was found near Manzanita Lake on the afternoon of June 6, 1926, was probably one that had metamorphosed during the previous summer.

At Turner's, on April 26, 1928, a toad was found beneath a board on damp ground. One at Spalding's, June 16, 1928, was picked up in a dense growth of weeds down near the shore of Eagle Lake.

On the evening of June 12, 1929, a large toad was seen half-buried in the sand in the flat grassy border of the lake shore near Eagle Lake Resort.

Bufo boreas halophilus Baird and Girard

California Toad

Limited in the section to the vicinity of the Sacramento River. Specimens obtained from: Coyote Creek, 270 feet; Blue Tent Creek, 350 feet; Red Bluff, 300 feet; Bloody Island, 350 feet.

At Red Bluff, on May 3, 1924, about dark, an adult toad was taken at the edge of the river. One was caught in a garden one mile from the river on May 10, and another was found on an island in the river on May 11. On April 9, 1928, two adults, one in the water of a pool and the other in grass close by, were picked up at dusk close to Blue Tent Creek, north of Red Bluff.

Many toad tadpoles were found in a shallow, gravel bottomed arm of a residual pool in Coyote Creek on April 7, 1928, and May 6, 1924. On the latter date the tadpoles were massed in water less than two inches deep at the edge of the pool. Here the unobstructed sunshine heated the water so that it was decidedly warm to the human touch. When alarmed the tadpoles moved into the deeper water of the main pool. (See fig. 17.)

Hyla regilla Baird and Girard

Pacific Tree-toad

Occurs widely throughout the section. Specimens collected at: Blue Tent Creek, 350 feet; Red Bluff, 300 feet; Cone's, 270 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Turner's, 3500 feet; Martin Creek at 5200 feet; Manzanita Lake, 6000 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Butte Lake, 6100 feet; Dransfield's, 5300 feet. Heard, also, at Cone's, 270 feet; Lyman's, 3300 feet; Mineral, 4900 feet; Eagle Lake Resort, 5200 feet. Observed but not collected at Petes Valley, 4500 feet, and Red Rock P. O., 5300 feet.

Found usually on rocks or herbaceous plants situated in or at the edges of small streams or lakes. At Silva's several tree-toads were found beneath boards at the edges of fields, when they were turned over in mid-afternoon of April 13, 1928. Evidently these retreats were sought so that a highly evaporative atmosphere might be avoided. On April 14, 1928, one individual was seen on a weed close to the pond at Elliott's and another was climbing a stem of *Scirpus* one-half meter above the water of the pond.

At Mill Creek one was found in the morning caught in a mousetrap, in some foxtail grass at least twenty yards from the water; date, June 9, 1912. On the next day one was picked up as it was hopping across dry sand and rocks. At Butte Lake, June 15 and 16, 1926, several individuals were seen on rocks in talus slopes and in ridges of broken lava. At Mineral on May 7, 1927, and at 8000 feet on Broke-off Mountain, June 17, 1925, choruses of hylas were heard at mid-day from water running under snow banks. After an early fall snow hylas appeared at Warner Creek, 6600 feet, on September 28, 1923, as soon as the weather moderated and the ground began to be free of snow in spots.

The firing of shot guns while collecting bats at Lake Helen on the evening of July 14, 1924, seemed to stimulate the hylas to croak. At least, immediately after each shot their calling was noted as more vigorous.

On July 12, 1928, nearly grown tadpoles of this species were seen in pools of a short stream below a springy place on the western slope of Petes Valley. A small pool in the creek bed in the floor of the valley contained many transforming larvae. In the sedges around the pool were several just emerged adults. During the next few days the pool dried rapidly. By noon of July 16 only a small puddle remained which would not last till evening. Among the hundreds of minnows crowding this pool were a few (6 ±) tadpoles in early stages of transformation. In the center of the puddle (at 11 a.m.) was a garter snake, probably there to eat some of these easily obtained last survivors of the drying pool. Evidently all the tree-toads that had not already transformed and left the pool were destined to die within a few hours, when there would be no trace of water. Here is a case where destruction of fishes and tadpoles was inevitable, if not by the snake then by another much more irresistible agency. This instance bears, obviously, upon interpretation of population control, such as, in economics, the assumed regulation of numbers by predators.

At Wilson Lake, July 10, 1928, large numbers of tree-toads, just metamorphosed and still showing stubs of tails, were seen. These young hylas were in the shallow water at the edge of the lake where grasses and sedges were growing.

At Dale's, May 19, 1924, a robin was seen carrying a tree-toad which it finally swallowed head first.

Tree-toads which measured 20.8 millimeters in total length and which evidently had just emerged from the tadpole stage were taken at Mill Creek, 260 feet altitude, on June 13, 1912. These had, by that date, reached practically the same size as small adults that were found at Warner Creek at 8000 feet, Warner Creek at 6600 feet, and at Hot Spring Valley, in late September and early October, 1923.

Fig. 120. Pacific tree toad (*Hyla regilla*) perched on exposed root of aspen. Photograph taken July 3, 1925, near Dransfield's.

The color of a tree-toad picked up at the edge of a stream at Cone's, April 24, 1928, was light green matching closely that of grass growing in the edge of the water. Of three individuals picked up from beneath alders along Martin Creek on July 3, 1928, two were bright, light green, the other ashy gray.

Four specimens (nos. 10069–72) collected at Dransfield's, July 3, 1925, are uniformly different from other specimens from other parts of the section.. (See fig. 120.) Each of these has a much darker tone of color than any other specimen from the section, and the skin in each is conspicuously granulated instead of being nearly or quite smooth. These conditions might be due to intense sunlight or to some other feature of the arid climate in the Great Basin territory. (See Test, 1898.)

Rana aurora draytonii Baird and Girard

California Red-legged Frog

Only one ascertained occurrence of this species in the section: one specimen taken, June 5, 1924, from a small stream which drains a pond at Elliott's, 1000 feet.

Rana boylii boylii Baird

California Yellow-legged Frog

Present in numbers in the western part of the section below 3300 feet altitude, as shown by specimens from the following localities: Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Elliott's, 1000 feet; Lyman's, 3300 feet

On April 5, 1928, several yellow-legged frogs were observed at the edge of a pool in a creek nine miles northeast of Red Bluff. When disturbed the animals jumped into the pool and swam to the deeper portion of the water, where each stuck its head beneath a small rock on the bottom, thus leaving most of the body exposed to view through the clear water.

On April 23, 1928, several adults were seen on wet rocks in a deep, narrow gorge of a small stream nine miles northeast of Red Bluff. One individual was found beneath a board lying two meters away from the edge of the water. Several masses of eggs were found attached to stones in the stream (Linsdale, MS).

Rana boylii sierrae Camp

Sierra Nevada Yellow-legged Frog

On July 3, 1928, this frog was observed commonly, and nine specimens collected, along the edges of Martin Creek near Mineral. The frogs were come upon, as the observer watched ahead, flattened down on the tops of damp drift logs above the water, at the water's edge, on the tops of perfectly dry rocks surrounded by water, or on pebbly ground in the shade. It was thought that the frogs were on the lookout for insects in these places. When alarmed from its position a frog would make for the swiftest and deepest water, but would soon reappear downstream, usually on the opposite shore.

Rana pretiosa pretiosa Baird and Girard

Western Spotted Frog

Found at every collecting station from Battle Creek Meadows on the west to Willow Lake on the east. Collected at the following places: Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet.

In a small lake near Lake Helen, on August 1, 1925, many individuals of this frog were seen in the warm marginal water. There was one frog for nearly every meter around the lake. All were adults of various sizes; no tadpoles were seen. The animals did not jump into the water from perches on the bank, but they were resting on rocks at the edge of the water and when alarmed simply swam out in a semicircle of less than a meter radius and back to shore. They were easily caught by hand. In some cases the frog would follow the fingers trailed in the water as if they were bait.

Our latest dates of capture of this animal in the fall are as follows: Warner Creek at 8000 feet, September 17, 1923; Warner Creek at 6600 feet, September 29, 1923; Drakesbad, 5500 feet, October 4, 1923. In the fall of 1923 the first heavy snowstorm in the mountains began on September 23.

REPTILES

Uta stansburiana stansburiana Baird and Girard

Northern Brown-shouldered Lizard

Found by us only in the extreme northeastern corner of the section, four miles northeast of Red Rock P. O., where two individuals were captured on July 25, 1928. Both these animals were among rocks on the side of a cañon.

Sceloporus graciosus gracilis Baird and Girard

Mountain Swift

Occurs from an altitude of 3300 feet on the western slope of the mountains east to the eastern boundary of our section. Specimens from: Lyman's, 3300 feet; Turner's, 3500 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; Kelly's, 5200 feet; Spalding's, 5200 feet; north end of Eagle Lake, 5200 feet; Gallatin's, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Jones', 5400 feet; four miles northeast of Red Rock P. O., 5400 feet. Others noted at Drakesbad, 5500 feet, and Butte Lake, 6100 feet.

A feeding mountain swift was seen on hot rocks within ten feet of escaping steam near Drakesbad, June 23, 1925. It took refuge, when pursued, under a hot rock and later escaped into a near-by crack. Individuals of this species usually were seen on the ground in sunny situations on rocky hillsides or among sage-bushes. One was found near Gallatin's, on May 28, 1925, on a ridge covered with mountain mahogany. Two that were seen at Butte Lake on June 19, 1926, were among rocks of a talus slope which bordered the lake.

At the north end of Eagle Lake, June 18, 1928, lizards of this species were notably numerous on the flat gravelly or stony ground beneath and between sage-bushes. When pursued, an individual would dodge about artfully among the stems of a sage-bush, but always keeping on the ground, not climbing up the stems. One was seen "courting" another on the surface of a low flat rock.

A female (no. 10080) collected June 9, 1926, at Manzanita Lake, contained three eggs each slightly more than ten millimeters in length. Another from Lyonsville (no. 10050) taken June 14, 1924, also contained three eggs nearly ten millimeters long.

Sceloporus occidentalis occidentalis Baird and Girard

Pacific Blue-bellied Lizard

Recorded in the section discontinuously, to the west of and below Turner's, and, across the main mountain mass, from north end of Eagle Lake eastward to the eastern boundary of the section (fig. 89). Collected at: Red Bluff, 300 feet; six miles north of Red Bluff, 350 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; four miles southeast of Manton, 3000 feet; Turner's, 3500 feet; north end Eagle Lake, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; four miles northeast of Red Rock P. O., 5400 feet.

At Red Bluff on May 3, 1924, a lizard of this species was shot while it was sunning itself on driftwood near the edge of the river. Another, on May 6, was caught in a mousetrap placed in a grapevine tangle. Also at this station several individuals were taken in mousetraps placed on sandy ground. One of the specimens from Bloody Island was found in a brush pile near the river. One was shot in a brush pile among digger pines at Manton on June 1, 1926.

Eight eggs, each about fifteen millimeters in length, were taken from a female (no. 10088) that was found, May 26, 1926, near Bloody Island.

On April 8, 1928, close to twenty individuals of this lizard were seen on the blue oak covered hills north of Red Bluff. A few were beneath logs and boards but nearly all were in the trees themselves. The animals were on the main trunks of the oaks, on horizontal limbs, and, in several instances, individuals were seen to jump from one branch or twig to another. In each case the jump was successful and the animal proceeded on its way. It seemed likely to the observer that the presence of the lizards in the trees might have been due to a greater supply of food there than was available on the ground. This choice of habitat may have had some significance in the mating behavior of the species. Usually, pairs were seen together in a tree and, in several instances, the more brightly colored animal pursued the duller one up and down the tree trunk. The dull ones, so far as observed, always kept out of reach.

In the eastern part of the section this kind of lizard climbed chiefly over rocks and boulders. So closely was this dependence maintained that individuals scarcely ever were seen away from rocks. This marked predilection for climbing is reflected in the structure of the animals. In this species the middle toes of the front feet are seen to be relatively long when compared with the toes of the ground-dwelling representative of the same genus (*S. graciosus gracilis*) which occurs in some of the same localities.

On the hills at the north end of Eagle Lake, in places where there were no boulders or broken outcrops, blue-bellied lizards were seen on the trunks of the large juniper trees.

Gerrhonotus palmeri (Stejneger)

Sierra Alligator Lizard

Ascertained occurrences are all on the western slope from 3000 feet to 6800 feet altitude (fig. 84). Taken at: Middle Antelope Creek at 3000 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet.

Nearly all the specimens of this species were taken on dry hillsides either among rocks or among bushes in the chaparral. The one taken at 3000 feet on Middle Antelope Creek on June 10, 1924, was on sandy ground under a board near the creek. One that was taken at Mineral, June 18, 1925, near noon, was squirming along among stems under *Ceanothus*.

A mating pair of alligator lizards in which the male held the head of the female diagonally crosswise in its mouth was taken in the disintegrating butt of a rotting log among lodgepole pines near Mineral; date June 1, 1927. The male of this pair weighed 21 grams and the female weighed 20 grams.

In the neighborhood of Turner's, on the mornings of April 26, 27, and 28, 1928, several individuals were picked up from beneath boards around sites of old buildings. Apparently the animals spent the night in such places and then remained there until late in the morning (at least 9 a.m.) when the air and ground were warmed by the sunshine.

Gerrhonotus scincicauda scincicauda (Skilton)

California Alligator Lizard

Found in the section only west of Manton (fig. 84). Specimens represent localities as follows: Red Bluff, 300 feet; Silva's, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; and Manton, 2300 feet.

After sunset on the evening of May 8, 1924, near Red Bluff, one of these lizards was seen running briskly, though heavily, from litter beneath a sycamore out into the open. One was picked up on a sandy ridge on an island in the Sacramento River on May 11. Two were caught in mousetraps on May 13. At Dale's on May 18, 1924, a specimen was caught in tall grass and weeds at the base of a cottonwood tree and within ten feet of a stream. Another was shot, May 23, three feet above the ground in a thick hopvine over rosebushes.

A mouse trap placed under a rotting log near Bloody Island on May 26, 1926, caught an alligator lizard. On June 2, 1924, one was found in a weed patch in which weeds were waist high. This latter animal was feeding, just before 6 a.m., and had two small green caterpillars in its mouth when it was caught. On December 29, 1927, two small alligator lizards, 70 and 78 millimeters long, were found, separately, under large boards close to irrigation ditches at Cone's. Apparently this species does not normally spend the winter so near the surface of the ground, for a large number of boards in this vicinity were turned over without any other individual being seen. Other individuals were found under boards at Cone's on April 16 and 24, 1928.

Cnemidophorus tesselatus mundus Camp

California Whip tailed Lizard

Noted at only the two stations where specimens were taken, namely, Mill Creek, 260 feet, and Dale's, 600 feet. Nearly all the ten specimens from Dale's were shot on sandy ground, and several of them were beneath clumps of willows, bunches of driftwood, or the edges of large boulders. In this neighborhood ground surface of a sandy nature occurred only in or near stream courses.

In the stomach of no. 9915 were five eggs, each fifteen millimeters long, which supposedly had been laid by some smaller species of lizard and eaten by the larger. Stomachs of others that were examined contained insects, both larvae and imagoes.

The available breeding data concerning this species in the Lassen section are summarized in the accompanying table.

No Mus Vert Zool.	Locality	Date	Number of eggs	Length of eggs
9914	Dale's	May 23, 1924	3	20 mm.
9916	Dale's	May 29, 1924	3	25 mm.
9918	Dale's	May 30, 1924	3	15 mm.

Eumeces skiltonianus (Baird and Girard)

Western Skink

Specimens were obtained from: seven miles northeast of Red Bluff, 350 feet, April 19, 1929; four miles southeast of Manton, 3000 feet, April 21, 1928; and Turner's, 3500 feet, April 26 and 27, 1928. Observed once near Mineral, 4900 feet, June 22, 1928.

The single specimen from southeast of Manton was found beneath a rotting log. When the log was overturned the skink went twisting away through the fallen, dead black oak leaves. In the vicinity of Turner's eighteen skinks were captured in two days. The animals were found beneath both logs and boards; but the greater number were obtained under boards around tumbled-down buildings at the edges of meadows. Usually only one was found under each board, but several would be close together in a small area. When the boards were turned over in early morning, before 9 A.M., the lizards could be captured easily by hand, as they would then be too cold to move rapidly. In the afternoon of April 27 an individual was seen on a rock in a tumbled-down rock fence bordering an open, grassy pasture. When disturbed it ran beneath the rocks.

On June 22, 1928, one mile west of Mineral two western skinks were seen, momentarily, in the heat of mid-day, on the floor of open woods among black oaks, yellow pines, and incense cedars; in each case the lizard found suitable retreat within or beneath large rotting logs.

A small individual was picked up, April 18, 1929, beneath a brush pile on a blue oak covered hillside seven miles northeast of Red Bluff.

Charina bottae (Blainville)

Rubber-snake

This species is listed by Van Denburgh (1922, p. 641) as having been taken at the south base of Lassen Peak and at Eagle Lake, Lassen County; but no particulars as to the circumstances of capture or present whereabouts of the specimens are given. (See also Townsend, 1887, p. 240.)

Stejneger (1890, p. 182) lists a specimen, number 9563 in the U. S. National Museum, as collected by Henshaw at Eagle Lake.

Coluber constrictor mormon Baird and Girard

Western Yellow-bellied Racer

Recorded at only eight localities, in the western end of the section below 3300 feet altitude and near the eastern border. Specimens saved from: Silva's, 270 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Red Rock P. O., 5300 feet. One seen at Gerber and another at Cone's, in the Sacramento River Valley. Observed also in Petes Valley, 4500 feet.

Situations in which individuals of this racer were found are: grass ten yards from a creek; amid water cress on damp ground near creek; bank of small ditch near meadow; barley field; sandy ground covered with rocks and driftwood, near a creek; among sedges close to small pool; in sage-brush along dry ditch; and in road near depressions filled with water in which plants were growing.

One was seen, April 24, 1928, swimming in an irrigation ditch at Cone's.

A racer that was caught near Dale's on May 18, 1924, contained a large cricket in its gullet.

Coluber lateralis (Hallowell)

California Striped Racer

Definitely recorded from three places: six miles north of Red Bluff, 400 feet, April 23, 1928; two miles north of Dale's, 700 feet, April 22, 1928; Manton, 2300 feet, May 30, 1926.

At Manton, one was shot at the margin of brush-covered land where it adjoined an orchard. The specimens from the two first listed localities were found on grassy slopes where there were scattering blue oaks. One was crawling into a pile of brush.

Pituophis catenifer deserticola Stejneger

Desert Gopher Snake

Two adult gopher snakes were caught, July 13, 1928, on the ground beneath a cottonwood tree in the center of Petes Valley. Another one was taken in the small marsh at the upper end of that valley; and a fourth one, moving through a meadow mouse runway, sprung a mouse trap that had just been set. The snake then crawled down into a large crack in the dry ground where it was soon out of sight.

The placing of the three east-end specimens under the name *deserticola* rests upon the features they show, of ventral scale counts, and number and color tone of spots on upper surface.

Pituophis catenifer heermanni (Hallowell)

Valley Gopher Snake

Frequent in western part of section up to 3200-foot contour line. Specimens taken at: Blue Tent Creek, 350 feet; Red Bluff, 300 feet; nine miles southeast of Red Bluff, 270 feet; Cone's, 270 feet; Dale's, 600 feet; Manton, 2300 feet; Lyonsville, 3200 feet. Presence established, but no specimens taken, at Mill Creek, 260 feet.

A gopher snake was found near Red Bluff on May 9, 1924, which was lying full length and quiet on leaf litter in shade under blue oaks. At Dale's one was caught in grass at edge of a potato field close to a creek. Individuals of this species were usually found in roads where the absence of cover of any sort made them conspicuous. Near Blue Tent Creek a gopher snake was come upon outstretched across a road with its head elevated six inches or so and held rigidly; date, May 9, 1924, toward evening. This snake was 1660 millimeters (5½ feet) long and weighed 978 grams.

At Cone's, April 6, 1928, a small individual was found beneath a board at the side of an irrigation ditch. Another individual was seen floating passively down a stream. When it was close to the observer the snake started swimming with lateral movements of the body and crossed at a right angle to the current and crawled into some drift in a thicket of poison oak. The snake's body gave an appearance of being buoyant in the water: the water line was low.

Lampropeltis getulus boylii (Baird and Girard)

Boyle King Snake

Found only on the plain of the Sacramento Valley and in the valleys of the larger tributary streams. Localities represented by specimens: Tehama, 250 feet; Mill Creek, 260 feet; Dale's, 600 feet. One seen smashed in road near Gerber, June 11, 1925.

At Dale's, May 25, 1924, in the evening when it was quite dark and cold, a king snake was found in short grass among lava boulders. Near Mill Creek on June 8, 1912, one crawled slowly from a road into a thicket of needle grass and blackberry, where it was easily obtained. At this same station one was seen in the open, which, when it was approached, lay still and rapidly vibrated its tail.

Contia tenuis (Baird and Girard)

Sharp-tailed Snake

Specimens of this snake were obtained at Silva's, 270 feet, April 12, 1928, and Cone's, 270 feet, April 6, 16, and 24, 1928. All the individuals were found coiled beneath boards, usually close to an irrigation ditch or a stream. Sometimes when picked up by hand a snake would bite at the fingers of its captor, but none succeeded in cutting through the skin.

Thamnophis ordinoides atratus (Kennicott)

Coast Garter Snake

Two specimens from Red Bluff, 300 feet, and three from Cone's, 270 feet, appear best referred to this race (fig. 96). One from near Red Bluff was in a thicket of sycamore shoots close to the Sacramento River. At Cone's one was found at the edge of a field, one at the side of an irrigation ditch, and the other beneath a board close to a ditch.

Thamnophis ordinoides couchii (Kennicott)

Giant Garter Snake

Garter snakes from Dale's, 600 feet, and Elliott's, 1000 feet, appear to belong to this race These snakes frequented brush and driftwood at the edges of streams.

Thamnophis ordinoides elegans (Baird and Girard)

Elegant Garter Snake

Most widely distributed race of this species in the section (fig. 96), as indicated by specimens from localities as follows: above Lyman's, 3300 feet; Turner's, 3500 feet; two miles west of Black Butte, 6800 feet; Willow Lake, 5600 feet; Eagle Lake Resort, 5200 feet; Petes Valley, 4500 feet; Box Springs, 5300 feet.

Definitely recorded situations in which examples of this snake were found were as follows: In willow clump close to clover field; under rock; in bottom of dry well; on ground on ridge covered with yellow pines. In Petes Valley two individuals were seen on the rocky walls of the cañon at the upper end of the valley and two others were seen at a nearly dried-up pool in the creek bed near the center of the valley. The snakes were likely attracted to this latter place by a concentrated abundance of food comprised in the crowded masses of minnows in the pool, as also tadpoles of the tree toad.

At Willow Lake a garter snake was seen July 25, 1924, eating a shrew that had been caught in a trap. A snake that was caught at Eagle Lake, May 23, 1925, when picked up disgorged a fish six centimeters long.

Thamnophis sirtalis infernalis (Blainville)

Pacific Garter Snake

Occurs chiefly on the western slope of the mountains. Specimens saved from: Coyote Creek, 270 feet; nine miles southeast of Red Bluff, 260 feet; Dale's, 600 feet; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Butte Lake, 6100 feet. Observed also at Elliott's, 1000 feet.

Late in the morning of April 12, 1928, close to twenty-five garter snakes of this race were seen and nine of them collected along the north, sun-facing bank of a ditch southeast of Red Bluff. The snakes were in patches of tall grass, on bare ground, and on heaps of tin cans and rubbish that had been dumped there. The day was warm and sunshiny. Apparently, the animals had taken advantage of the warmest situations in the vicinity and there they exposed themselves to the gentle heat from the sun.

Most of the other individuals that were collected were found close to water either near streams or at the edges of ponds and lakes. One at Coyote Creek was in scant vegetation at the edge of an intermittent prairie stream. One at Manzanita Lake was picked up on a chaparral covered slope.

At Dale's a brilliantly colored individual of this species was observed close to a certain bush on May 18, 1924. Later, on May 30, a snake thought from its size and brightness to be the same individual was picked up only two meters away from this point. This suggests that these snakes, as individuals, have definite "homes" that are more or less permanent.

A garter snake that was taken, June 14, 1926, from shallow water in the edge of Butte Lake was capturing and eating the black tadpoles of toads. Several of the tadpoles were disgorged by the snake when it was picked up.

Crotalus oreganus Holbrook

Pacific Rattlesnake

Definitely recorded within the section only four times: at Dale's, 600 feet; Spalding's, 5200 feet; eight miles southwest of Ravendale, 5600 feet; four miles northeast of Red Rock P. O., 5400 feet. The snake captured at Dale's (no. 9989), a very small one, was found coiled near the edge of a dry rocky wash. When the stock of a shotgun was placed near the snake it reached out and touched the wood with its tongue. Instead of striking, when the gun was placed closer, the snake turned and crawled away.

Residents in the vicinity of Eagle Lake testify that rattlesnakes are fairly common in that region, although only one was actually seen near there by museum parties. The track of one was found July 9, 1925, at Box Springs.

On July 25, 1928, a rattlesnake was shot in the northeast corner of the section. The fine shot of the charge hit the snake one-fourth of the way from the head to the tail. The animal did not die immediately. In its twisting it opened its mouth widely and once turned its head and clamped its jaws tightly across its own body. It seemed to sink the fangs into its own flesh. Probably this reaction of the dying snake is the basis of the statement, often heard, that rattlesnakes bite themselves to death. In a trail close to where the above mentioned snake was found, a half-grown cottontail was seen. The rabbit seemed to be frightened—so much so that it would not hurry away when closely approached. The cause of the rabbit's peculiar behavior—whether terrified by the snake itself or by its rattling, or possibly it had been bitten—was not determined.

A dead rattlesnake that had been recently killed was seen, June 19, 1929, at the side of the road eight miles southwest of Ravendale.

Clemmys marmorata (Baird and Girard)

Pacific Mud Turtle

Found along the Sacramento River and along tributary streams to at least as high as 3500 feet. Specimens taken represent the following localities: nine miles northeast of Red Bluff, 350 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; near Payne Creek P. O., 1800 feet. Mud turtles were seen but not collected at the following additional places: Coyote Creek, 270 feet; Cone's, 270 feet; Turner's, 3500 feet. Most of the turtles that were captured were taken from pools in creeks. One was found on May 29, 1926, on the ground in a grove of valley oaks near Bloody Island.

On April 7, 1928, two turtles were seen sunning themselves on some drift accumulated on a clump of *Scirpus*. Another one was seen at the edge of a pool where it was eating a larva of some large neuropteroid insect. When the turtle was picked up it partly disgorged its captive but did not give it up entirely.

Several individuals were seen, April 26, 1928, in pools of a small stream in the meadow at Turner's. When disturbed, the animals would dive and hide beneath boards and logs in the bottoms of the pools.

BIRDS

Gavia immer (Brünnich)

Common Loon

From May 18 to 23, 1925, a pair of loons was observed, several times, near some rocky islets on the west side of Eagle Lake. One month later, June 26, a search was made for these birds, but neither of them could be found. Two loons were seen in the northern part of Eagle Lake on September 28, 1924. Mr. George Collins told us that during the summer of 1928 he had seen and heard a single loon on Snag Lake.

Several series of calls heard at the south end of Eagle Lake on the evening of June 11, 1929, were thought to be those of a loon although the bird was not seen. The call was a loud, high-pitched, single-toned series of close to ten syllables and was louder than any other bird-call heard on the lake.

In July, 1878, Henshaw (1879, p. 333) met with this species several times on Eagle Lake, "where," he says, "a number of pairs breed [bred at that time] regularly."

In June and July, 1884, Townsend (1887, pp. 190–191) visited several of the then "wild secluded" lakes east of Lassen Peak, "each of which had its pair of Loons.'' He says further: ''On July 10 I waded out to a narrow sand bar in Butte Lake, upon which a Loon had been sitting, and found her nest or rather egg, ... which was lying on the bare sand.'' Efforts to shoot a loon here ''proved quite unavailing'' for the birds kept ''far out of shotgun range.''

In the summer of 1905, Sheldon (1907, p. 186) considered the common loon to be ''fairly numerous'' on Eagle Lake, ''but very wary and hard to approach.'' One specimen was obtained.

Colymbus nigricollis californicus (Heermann)

American Eared Grebe

Found as a common transient on Eagle Lake and, less frequently, on small bodies of water elsewhere in the section; breeding on at least one of these ponds, near Red Rock Creek. Two specimens were taken October 6, 1924, at a pond five miles north of Fredonyer Peak, 5700 feet, and five on Red Rock Creek, 5300 feet. Observed also at following stations: Wilson Lake, 5100 feet; Eagle Lake Resort, 5200 feet, May 14, 1925; Spalding's, 5200 feet, October 12, 1923; Gallatin's, 5200 feet.

Thirteen eared grebes, all in full breeding plumage, were counted in sight at one time on Wilson Lake, May 18, 1927. They kept close together on open water where deepest; there they preened, sometimes rolling on their sides, showing then their white bellies, and they gave now and then their characteristic summer calls (Grinnell, MS). No grebes were seen on the lake a week later. Three were seen at Wilson Lake on June 15, 1928.

As many as 100 pairs of this bird were found along a five-mile stretch of the western shore of Eagle Lake in May, 1925. One month later (June 26) only one pair could be found in the same place (Dixon, MS).

On June 11, 1929, several individuals were swimming close to the southern shore of Eagle Lake. One group of six together was seen close to the rocky shore one mile south of Eagle Lake Resort. This group hurried to get out of the way of a lone pelican that swam by; one bird even used its wings to move at a faster rate over the water. The next day fourteen individuals were counted in one group near this place. On June 13, several eared grebes were observed scattered close to the lake shore near Spalding's. All the evidence indicated that no birds of this species could nest on the lake that season, for want of a suitable nesting place.

A family group of at least one adult male and eight young birds was seen swimming together, July 26, 1928, in a small open pool along the creek four miles northwest of Red Rock P. O. Two single young were found out in shallow water where vegetation (sedges and grasses) was thick. These young birds moved beneath the surface of the water, their courses marked by its disturbance; then, coming up, only their backs would show above the surface, partly hidden in the vegetation. One of them was picked up alive in the hand. Two young males collected, July 26, weighed 221.3 and 230.2 grams. Two young females weighed 138.8 and 189.2 grams. The adult male with the brood weighed 336.3 grams.

The two specimens, birds of the year, male and a female, from a pond five miles north of Fredonyer Peak, weighed 278 and 337 grams, respectively.

Aechmophorus occidentalis (Lawrence)

Western Grebe

Found in summer regularly and in considerable numbers on Eagle Lake, 5200 feet. Observed at various points around the lake from May 14 (1925) to October 12 (1923). A specimen was taken at Gallatin's, July 10, 1925 (preserved July 12). Also a single individual was seen in deep water near the outlet of an irrigation reservoir at Jones', 5400 feet, July 25 and 26, 1928.

In 1921, the number of western grebes observed on Eagle Lake was less than fifty individuals. Nearly 100 pairs were found on the southern portion of the lake in mid-May, 1925. On September 28, 1923, several hundred were noted at the north end of the lake.

A young western grebe (no. 45949), apparently not more than one day old, was washed ashore July 10, 1925, on the southeast side of the lake. This bird weighed 41 grams. The nearest tules were located on the west side of the lake and it was thought that this bird had drifted from a nest there (Dixon, MS).

Near Spalding's, in a tract of tules at the northwestern side of the lake, on June 9, 1925, Mr. James Moffitt (MS) found approximately 500 pairs of western grebes breeding. Most of the nests contained four or five eggs, some nests as yet held no eggs, and one brood of young was noted.

In 1905, Sheldon (1907, p. 186) found the western grebe "quite common" at Eagle Lake. A set of four eggs was taken on June 30.

The western grebe was the commonest water bird in sight, June 16–18, 1928, on the southwestern and northern parts of Eagle Lake. Discordant cries of these grebes and sounds made by their rapid rushes over the water were heard at intervals during each night.

No tules for nesting sites could be seen from any of the points that were visited and none was heard of as growing that year on any part of the lake shore. Most of the grebes were scattered, two together. Later, on July 27, grebes were still scattered in two's, and several were seen performing courtship antics. Apparently no successful nesting took place in 1928.

On June 11, 1929, many pairs and single individuals of this grebe were swimming, scattered out over the southern portion of the lake. Usually the birds of each pair swam close together. When one dived the other would quickly go under and the two would come up near together but several meters away from where they went down. The birds were much more noisy in the evening and at night than in the daytime. In the early morning most of the pairs in sight were resting with their heads laid on their backs. At midday scarcely any were heard.

Podilymbus podiceps podiceps (Linnaeus)

Northern Pied-billed Grebe

A bird that was seen, July 21, 1924, at Willow Lake, 5600 feet, was thought to be of this species (Hunt, MS). On June 9, 1925, Mr. James Moffitt found two pairs of pied-billed grebes on Eagle Lake near Spalding's. One pair had a brood of five or six downy young. One of these young was captured and preserved as a specimen (no. 382, coll. J. Moffitt) which we have examined in comparison with the young of the other two species of grebes occurring in this region.

On June 24, 1929, at Feather Lake two or three individuals of this grebe were seen swimming singly in open water at the edge of a patch of bulrushes.

In 1905, Sheldon (1907, p. 186) found this grebe to be a "common breeder" at Eagle Lake. Many young were seen, and one "in down" was taken August 1.

Pelecanus erythrorhynchos Gmelin

American White Pelican

Flocks of pelicans, numbering up to eighty individuals, were seen along the Sacramento River, at Tehama, December 28, 1927, and in the neighborhood of Red Bluff on April 17, 1929, and from May 2 to 14, 1924. This species is reported to stay in this vicinity all winter. On May 17, 1924, a flock of eleven birds was seen circling above Lassen Peak. Pelicans were observed in summer (May and June, 1921–25, '28 and '29) on Eagle Lake in the vicinity of Eagle Lake Resort and Spalding's.

Pelicans that were observed on the Sacramento River, when not flying, were resting on the water or standing in the shallows of riffles or on gravel bars (fig. 19). Near Eagle Lake, 1925, an individual was seen feeding in a pond back in the woods from the lake. When not feeding out in the lake the birds then spent their time loafing on an island exposed near the center of the lake; as many as 100 were seen there at one time. On May 29, during a period when the water was rough because of strong wind, the pelicans went ashore on the leeward side of some rocky islets.

Fig. 121. Nest and eggshells of white pelican (*Pelecanus erythrorhynchos*) on an island in Eagle Lake. After the brooding birds had been frightened away by persons, the California gulls pillaged every nest. Photograph taken June 22, 1921. Mus. Vert. Zool. no. 3652.

On June 21, 1921, a colony of pelicans was visited, whose nesting ground on an island in Eagle Lake had recently been broken up. Two hundred and fifty-three birds were counted about the island and it was known that at least fifty others were at the same time fishing on the lake. There were four dead birds that had met death within two or three weeks, and holes in their bones indicated that they had been shot on the breeding ground. Over 100 nests were examined, but not one whole egg or live young bird was found. Apparently, after the pelicans had been frightened from the island by the shots the gulls proceeded to peck holes in all the eggs (fig. 121). People who lived near the lake were effectively unfriendly toward the pelicans because, in their opinion, the birds destroyed too many fishes. Many shells of pelicans' eggs were found about a nest of black-billed magpies on the lake shore one-fourth of a mile away (Dixon, MS).

Again, in 1928, a colony of white pelicans had occupied early in the season an island newly exposed by the lowering water. Young, by hearsay numbering "more than a thousand," were killed there prior to June 17 by persons "from Susanville," who resented the presence of competing "fishermen."

A visit was made, June 13, 1929, to the large island in Eagle Lake where pelicans were nesting. Adults numbering close to 200 were sitting in groups on different parts of the island or swimming in the lake close by. Two small groups of nests were seen at places where there were large blocks of broken lava and clumps of a large white loco weed nearly one meter high. Some of the nests contained eggs, part of these clean and apparently newly laid and part soiled, possibly infertile. Only a few of the eggs had holes in their sides as if they had been eaten by some animal; gulls were likely responsible.

The young on the island were estimated to number close to 100, of ages from many just hatched to some covered with white down and from one-fourth to one-third grown. An equal number of dead young was seen. Not one that was examined showed evidence of having been killed by violence or even of having been eaten into after death. Seemingly, the high rate of mortality here was due to some other cause than being preyed upon by other animals, possibly exposure, desertion, or trampling. Whatever the cause of death it seemed to affect all ages of the young.

Mr. S. A. Webb, of Spalding's, who also visited the island on June 13, said that he had been there late the previous summer (1928) and had seen a much larger number of young than were present in 1929. He thought that many of these young had matured. That visit had been made after the slaughter in early June of young pelicans by persons. The pile of skeletons which had been left by these persons was examined. Surely there were not many hundreds of individuals represented there. These facts were taken to indicate that the 1928 season could be counted a successful one for the pelicans and that a smaller brood would be reared in 1929, provided there would be no serious molestation of the colony.

When the adult pelicans rose at our approach to the nests no move could be detected on the part of the many gulls present to molest any of the eggs or young. The gulls remained in the air while we were near, and the pelicans returned to their nests as soon as we withdrew a short distance (Linsdale, MS).

On July 4, 1877, Henshaw (1879, p. 329) visited a colony "of from 500 to 1,000 pairs that had established themselves on a sandy island in Eagle Lake. . . . . At this date the young were present in all stages of growth. . . . . A rough estimate" placed the number of young present "at considerably over 1,000 . . . . ".

On June 28, 1884, Townsend (1887, p. 192) found "great numbers" breeding on Eagle Lake, resorting chiefly to one of two islands, the other being occupied by cormorants.

Phalacrocorax auritus albociliatus Ridgway

Farallon Double-crested Cormorant

Limited in the Lassen section to the Sacramento River and to the lakes east of the mountains. A specimen was preserved from near Spalding's, 5200 feet, on Eagle Lake. Observed: near Red Bluff in January, May and December; at Bloody Island in May; on Willow Lake, 5600 feet, in July; and at Eagle Lake Resort, Spalding's and Gallatin's, on Eagle Lake, 5200 feet, during the summer. At the north end of the lake individuals were seen so late as September 28, 1924.

The cormorants that were seen along the Sacramento River usually were drifting, solitarily, with the current, diving at intervals apparently for fish, and finally flying back to about the starting point to repeat. One individual that was observed near Red Bluff had as its perching place one of the branches of a dead sycamore which was undercut and leaning out over deep water below a high bank. At Eagle Lake a few cormorants used as loafing places the small rocks which projected above the water. An instance of interspecific competition for one of these desirable resting places was noted on June 1, 1925, when a cormorant drove a sleeping American merganser from a rock which it had selected for a perch (Dixon, MS).

A female, no. 45948, that was collected May 26, 1925, weighed five pounds.

The members of the cormorant colony at Eagle Lake that were not brooding returned each evening to roost near the nests. On June 24, 1921, these returning birds began to arrive at seven P. M. They arrived in groups of from three to six in single file and always circled about so as to land against the wind. Just before reaching its perch each bird would shoot quickly upward, spreading out its toes and extending its legs so that the flight was checked by as large an opposed surface as possible (Dixon, MS).

Sounds that were made in a cormorant colony at four o'clock in the morning of May 27, 1925, were loud enough to awaken a person sleeping more than 100 meters distant. These sounds, which make up a part of the mating behavior of the species, were "cork-pulling" noises which in the distance sounded like pigs grunting hoarsely. During this performance two adults usually faced one another. Then, one would swell its neck, open its bill widely and "cough up" the grunt (Dixon, MS).

Fig. 122. Nests of Farallon double crested cormorant (*Phalacrocorax auritus albociliatus*) on the ground of an island in Eagle Lake. Photograph taken June 22, 1921. Mus. Vert. Zool. no. 3659.

On several occasions a bird was seen to alight on a nest and immediately give food to its brooding mate. This food was evidently carried in the gullet, since no trace of it could be seen projecting from the mouth. Males were seen to share in the duty of incubation.

In 1921, the cormorants were nesting on a small island near the east shore of Eagle Lake (fig. 122). The island was two or three meters above the water at its center and was covered with old, dead mountain mahogany trees ten to twelve feet in height and with a vigorous growth of large river nettles. In one tree there were five nests. Fifty-six nests were counted in the trees and there were at least twenty more in low bushes. On a near-by reef of rocks were approximately fifteen nests, sunk in crannies among the bare blocks of lava. By 1925 the water in the lake had lowered so that both these situations

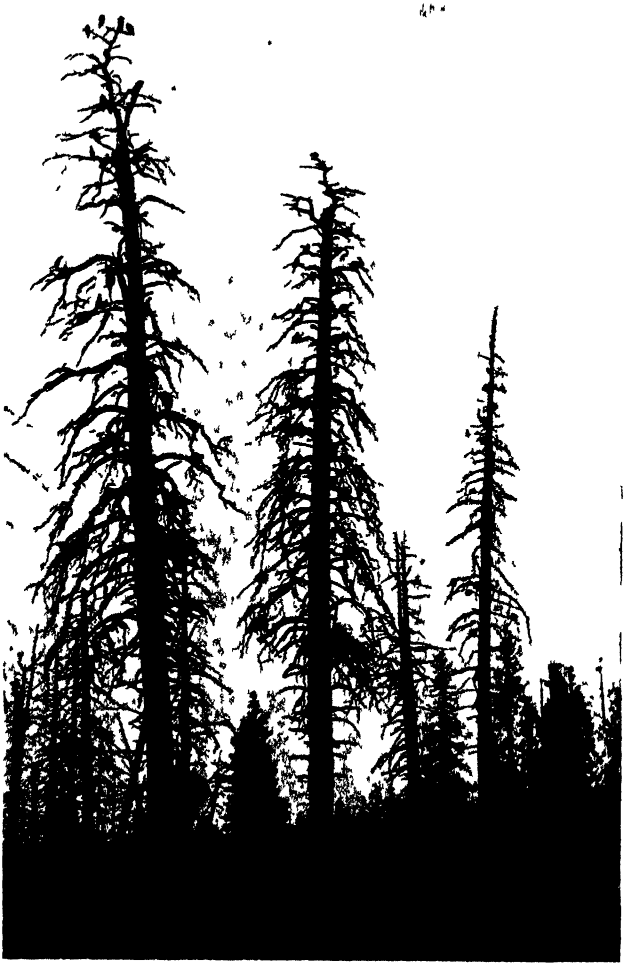


Fig. 123. Site of a nesting colony of Farallon double-crested cormorant (*Phalacrocorax auritus albociliatus*) in dead yellow pines of the stub-forest. Photograph taken May 26, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4583.

were connected with the shore by land. Cormorants did not nest there that season; but a colony was then found on the west side of the lake where as many as ten pairs occupied one nest tree in the stub-forest of dead yellow pines.

Cormorants on May 26, 1925, were still carrying nest materials to the nests in the stub-forest (fig. 123). In two instances long, green tules were seen streaming back from the bird's mouth as it flew to the nest. Sometimes bits of moss or fibrous roots were brought. Nests that were placed on the reef of rocks (in 1921) were composed largely of the black shed primaries of the white pelican (Dixon, MS).

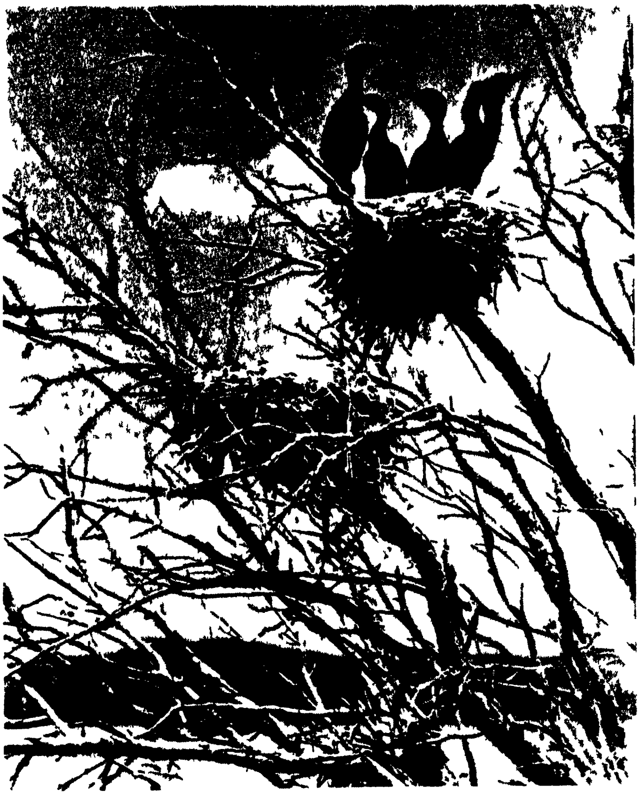


Fig 124 Brood of five young Farallon double crested cormorants (*Phalacrocorax auritus albociliatus*) Birds at this age begin to clamber about the nest trees and perch away from the nest Photograph taken June 21, 1921, at Eagle Lake Mus Vert Zool no 3661

Pieces of fish, apparently dropped by accident, were found in and beneath nests in which there were young birds. Most of these were pieces of black bass and white fish (local names) that had originally averaged from 15 to 30 centimeters in length. Often, only the head of the fish had been eaten.

Most of the young birds in the colony that was observed on June 21, 1921, were uniform in size, and they were nearly ready to leave their nests (fig. 124). Some of them were able to fly short distances—up to five meters. When a nest tree was approached to within three meters by the observer, the young birds would begin to clamber out of the nest and go up into the higher branches. The birds appeared extremely awkward in making this climb and they frequently lost their balance, when, unless they could catch their long snaky necks or their wings over a branch, they would fall clear to the ground. Thereupon they usually began the slow and laborious climb back into the tree. Once a bird got its neck hooked over a limb it would hang on stubbornly, often resting for a few minutes (2 to 5); then it would flap its wings vigorously and with the aid of its sharp claws would finally get back into the tree.

Instinct appeared to direct some of the older birds to the water rather than back to the trees, after they had fallen. Such birds could not support their heavy bodies on their legs, but they dragged themselves forward over the ground, flapping their wings. These birds, as soon as they reached the water, would plunge in and when they were eight meters off-shore, some would dive and swim under water up to as far as thirty meters the first dive (Dixon, MS).

In one tree which held five nests of the colony studied in 1921, there were eighteen young, all ready to leave their nests; so that it was thought the nestling mortality could not have been high in that particular group. One nest in that tree held five young. Although most of the young birds were uniformly nearly full-grown, three nests each contained three half-grown birds. On this same day (June 21) the near-by nests on the rocky reef held eggs ranging in number from two to five, but averaging two or three. These were thought to represent second nestings.

The most conspicuous enemy of cormorants in the Eagle Lake region was the California gull, individuals of which were constantly on hand and ready to gobble up any eggs the minute they were left unprotected. One gull was seen actually to remove and eat two out of five eggs in a cormorant's nest. The skull of a mink, with some hair attached, was found under a cormorant's nest. This animal had been in summer pelage when it met death and it may have been after the young cormorants (Dixon, MS).

On June 28, 1884, Townsend (1887, p. 192) "found a large colony breeding upon a small rocky islet in Eagle Lake, their nests being made of reeds and rushes, which they must have carried from the shore a mile away."

Ardea herodias hyperonca Oberholser

California Great Blue Heron

A widely distributed resident in the section. Specimens were obtained at Dale's, 600 feet, and Eagle Lake Resort, 5200 feet. Stations otherwise, where occurrence was established by observation are: Red Bluff, 300 feet; Cone's 270 feet; Bloody Island, 350 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Mineral, 4900 feet, December 21, 1927; Willow Lake, 5600 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; five miles north of Fredonyer Peak, 5700 feet; Petes Valley, 4500 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet; Jones', 5400 feet.

The usual feeding ground of the great blue heron in the section was comprised in margins and shallow portions of the streams and ponds or marshes. Near Bloody Island on May 27, 1926, several individuals were feeding in the water of Battle Creek, where there was considerable current and where the water was sufficiently deep that, when a bird waded, the water was seen to touch its folded wings and to cover part of its tail (Linsdale, MS). A pair was seen on May 28, 1925, in the cattail marsh at the head of Willow Creek.

Tracks of a heron were seen close to a stream near Mineral on December 20, 1927. The bird had walked through the snow at the edge of the stream and had walked out into clearings, rather than going into the water, to get around thickets that were close to the water. On several occasions in winter near Dale's, herons were caught in steel traps that had been set to catch coons in shallow water at the edge of a stream.

One individual that was observed along the Sacramento River near Red Bluff in May, 1924, perched habitually on branches of a dead sycamore that was leaning over deep water below a high bank.

A female that was trapped weighed 3½ pounds; two males weighed 4¾ and 5¼ pounds.

This species of heron nested in large dead pines of the stub-forest at the edge of Eagle Lake in 1925; young birds, two-thirds grown, were seen there on May 26. In 1921, nearly all the nests that were seen at Eagle Lake were in live yellow pines. Young birds that were nearly grown were seen leaving one of the nests on June 23 of that year.

Observations that were made at Eagle Lake on May 26, 1925, indicate that young herons are well able to care for themselves while in the nests even when not attended by their parents. A turkey vulture hopped down from the top of the nest-tree to within one meter of the nest. Suddenly, a young two-thirds grown heron in the nest jumped to its feet and made a thrust at the intruder. At the same time, it gave voice to a loud squawk. The vulture "dropped" from its perch instantly and hurried away as fast as it possibly could (Dixon, MS).

On June 13, 1929, on the west side of Eagle Lake, south of Spalding's, a colony of nesting great blue herons was observed in a group of dead yellow pines about one mile back from the lake. Twenty-three occupied nests were counted in eight trees and from twenty to thirty meters up. In most of the nests young could be seen, apparently about half-grown. Adults were standing on some of the nests. The nests were all gray in color, contrasting with the near-by darker colored nests of ospreys. Those of the herons were also more rounded in outline and they had more loose sticks straggling from them. One dead young heron was seen on the ground beneath the nests.

Butorides virescens anthonyi (Mearns)

Anthony Green Heron

A specimen was collected, May 11, 1924, near Red Bluff, 300 feet. Single birds or pairs were observed at: Red Bluff, 300 feet, May 7, 1924; Dale's, 600 feet, May 18 and 25, 1924; Elliott's, 1000 feet, September 1, 1925.

Green herons were found near Red Bluff frequenting willows overhanging the water on an island in the Sacramento River. At Dale's a bird was seen near an irrigation ditch. The only one observed at Elliott's flew into some willows near a pond. In the evening of April 11, 1928, one flew to the top of a valley oak near the highway, two miles east of Red Bluff and close to a small, willow bordered creek.

The specimen from Red Bluff was a female which weighed 250 grams. This bird in-the-flesh measured 470 millimeters in length, of which head, neck and bill made up 300 millimeters. Some color notes based on a comparison with Ridgway's Color Standards (1912) within one hour after the death of the bird are as follows: Iris, apricot yellow; bare skin around eye and bordering brow, reed yellow; bill, chaetura black, save for ridge of gonys which is reed yellow; legs and tops of toes, deep colonial buff; soles of toes and bottom of heel, primuline yellow; claws, buffy citrine. This bird contained large ova and it was thought to be nearly ready to nest in that vicinity (Grinnell, MS).

Townsend (1887, p. 197) obtained a specimen at Red Bluff, May 9, 1884.

Nycticorax nycticorax naevius (Boddaert)

American Black-crowned Night Heron

A single night heron was seen on May 7, 1924, in flight over the Sacramento River near Red Bluff. Three others were seen, May 13, during a trip by boat from Red Bluff to Tehama. One bird was seen on May 28, 1925, in a cat-tail swamp at the head of Willow Creek close to Gallatin's, 5200 feet. A young female night heron, weight 505.4 grams, was shot, July 24, 1928, at the edge of a slough in a hayfield at Red Rock P. O. Another one was seen there on July 26. Another was flushed from the top of a willow thicket near the stream in Secret Valley on June 15, 1929.

Botaurus lentiginosus (Montagu)

American Bittern

In the summer of 1905, when the water of Eagle Lake was at a high level and the shores were lined with tules, the notes of the bittern were heard there on several occasions by H. H. Sheldon (1907, p. 187). Also a bird was flushed by the same observer from a swamp in Pappoose Valley, near Eagle Lake, on June 28.

Plegadis guarauna (Linnaeus)

White-faced Glossy Ibis

A single white-faced glossy ibis was seen, July 26, 1928, in the wet hay meadow four miles northwest of Red Rock P. O., 5300 feet altitude. The bird would fly up when approached to within 100 meters and, with a few hoarse notes, would fly to the opposite end of the field; sometimes it would circle two or three times, but always out of shotgun range. This bird flew as high as, or higher than, any of the other water birds present at that place.

Cygnus columbianus (Ord)

Whistling Swan

During the mid-winter of 1927–28, swans were reported as occurring regularly at a rain-pool on the mesa two miles north of Dale's. A female which weighed twelve pounds was collected there, January 13, 1928. Three individuals were seen, October 21, 1924, at Spalding's, on Eagle Lake, and it was reported that a flock of thirteen birds remained in the vicinity throughout the fall of that year.

Branta canadensis canadensis (Linnaeus)

Honker Canada Goose

This goose nested at several of the mountain lakes in the section. A few flocks were observed in winter in the lower western portion of the area. The only specimen obtained (no. 45187) was a young one from Willow Lake, shot July 24, 1924.

At a point eight miles south of Red Bluff, January 2, 1928, geese thought to be of this race were in almost constant movement. Nine separate flocks or groups were counted in the air at one time. Some flat fields close to the Sacramento River, where there was some standing water, appeared to attract the birds.

During April, 1928, flocks of geese were observed almost daily at various places eastward as far as Manton. All these flocks were high in the air and all were moving northward.

A flock of sixteen Canada geese was observed, December 27, 1927, flying south low over Inskip Hill. This was doubtless just a local movement. On December 20 eight passed overhead, going northeast, at 6000 feet altitude over a ridge northeast of Mineral. The birds gave calls every now and then, low-pitched and startlingly like a human voice, sounding forth in the silent winter wilderness!

Mr. Ted Wells told us at Mineral that a year or so before 1924, a pair of Canada geese had nested on Battle Creek Meadows and that the brood had been reared successfully.

On June 8, 1926, a nest and three deserted eggs of this goose were collected at Manzanita Lake. (See fig. 11.) The nest was on top of a decaying log twenty-five meters out in the water from the southern shore of the lake. The log was covered with moss, and willows were growing closely enough together on it to make a screen for the nest. No geese were seen in that vicinity during the week spent there. Evidently the nest had been abandoned soon after the eggs were laid, probably at the time people first came and camped near the lake that season (Linsdale, MS).

This nest and set of eggs were preserved (no. 2046 in M. V. Z.). The nest, as saved, is a mass, some 400 millimeters across and 80 deep, of yellow (that is, the previous year's) grasses such as grow in water, stems of plants, willow bark strips, flakes of pine bark, and down feathers of the goose. The eggs are dull white, save as nest-stained and weathered, and measure in millimeters: 93.0 by 56.2; 93.6 by 66.5; 85.0 by 55.3.

At least one pair of Canada geese nested at Wilson Lake in 1927. There, on May 24, a pair with one small gosling swam from shore out into the dry grass rising above the water toward the middle of the lake; another pair was flushed from the lava side of the lake; two pairs together were seen in flight; and five individuals flew over high up and apparently heading off northeast.

On Willow Lake, July 18 and 24, 1924, two old geese and three young ones were observed.

At Snag Lake on June 25, 1929, an adult was seen swimming out in the lake with five young geese about half grown.

On Eagle Lake, May 14, 1925, three mated pairs of geese were observed. The females seemed to take the initiative both in performing antics before the mate and in resenting the close approach of other pairs. On May 18 two adults and three young geese were found in a small pond back from the shore of the lake. When approached by the observer, all these birds swam to the opposite side of the pond and waddled off quietly, but with astonishing rapidity, through the woods to the main lake. When first come upon, the adult geese honked loudly, but when they started to sneak away they became entirely quiet. At least two family groups were observed, May 20, on the main part of the lake (Dixon, MS).

At the north end of Eagle Lake, on June 17, 1928, four downy young geese were seen accompanied by two solicitous adults.

Eight old birds, and nine young all about ten days or possibly two weeks old, were seen in a bay off Stone's [Eagle Lake] June 9, 1925 (J. Moffitt, MS).

On an irrigation reservoir near Jones' July 22, 1928, one group of nine young geese, feathered but probably unable to fly, was seen swimming out in the water. Another group of smaller young, twenty-five or thirty together, was also seen on the water. On July 24, in addition to the young birds, twelve adults were seen standing on the mud at the edge of the reservoir.

Branta canadensis minima Ridgway

Cackling Canada Goose

A single specimen (no. 52756) was obtained at an intermittent lake two miles north of Dale's on April 25, 1928. It was a male, weight 2.5 pounds. No other goose was seen in that vicinity on that date.

On May 14, 1924, one individual was observed in company of a snow goose at the side of the Sacramento River near Tehama (Grinnell, MS). Both these birds likely were seasonal laggards; possibly each had been injured in the previous hunting season.

Anser albifrons albifrons (Scopoli)

Common White-fronted Goose

Flocks of geese of this species were seen several times during October, 1924, flying in a westerly direction over two stations in the eastern part of the section: five miles north of Fredonyer Peak, 5700 feet; Box Springs, 5300 feet (Dixon, MS).

In the latter part of December, 1927, flocks were seen on different days passing back and forth over the Sacramento River and the west-side rain-flooded plains between Red Bluff and Tehama.

A single female was collected at a rain-pool two miles north of Dale's on April 22, 1928. Flocks of geese were seen at the same time going north in flight overhead.

Flocks of geese of this species were seen going north at Coyote Creek on April 17, 1929, and near Tehama, April 20, 1929.

Chen hyperboreus hyperboreus (Pallas)

Lesser Snow Goose

A single individual was observed on May 14, 1924, along the Sacramento River near Tehama. This bird along with a cackling goose was sitting and resting on a sand bar. When closely approached, both birds got up and waddled up the river bank. Presently, the two birds took flight and left toward the north (Grinnell, MS). There is probability that these were slightly disabled individuals, relics from the hunting season, and not regularly migrating birds.

Townsend (1887, p. 195) narrates that "on one occasion at Red Bluff, while watching the incessant northward movement of the geese from the Sacramento Valley, I [he] saw a triangle of Canada geese headed by a single one of this species, the two waving lines of dark forms converging in a snow white point."

Anas platyrhynchos platyrhynchos Linnaeus

Common Mallard

Found at more stations in the section than was any other species of duck. Specimens were obtained at Spalding's, 5200 feet, May 24, 1925, and October 26, 1923, five miles north of Fredonyer Peak, 5700 feet, September 30, 1924, and at Jones', 5400 feet, July 22, 1928. Observed also at following additional localities: Red Bluff, 300 feet (May 9, 1924); Dale's, 600 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Willow Lake, 5600 feet; Feather Lake, 5500 feet; Gallatin's, 5200 feet; Petes Valley, 4500 feet; Red Rock P. O., 5300 feet.

Near Warner Creek at 8000 feet a female mallard with a brood of six full-fledged young was flushed September 17, 1923, from a grassy pond sheltered by timber. On September 24, 1923, sixteen mallards were observed feeding along the margin of Warner Creek at 6600 feet where this stream meanders through a small flat. At that time snow covered the ground in the vicinity. From 100 to 150 individuals were present, October 12, 1923, along the then tule-lined shore of Eagle Lake near Spalding's.

It was reported to us that in the vicinity of Red Bluff this is the commonest duck in winter and that a few broods of young have been seen in summer.

A male, shot May 24, weighed 1363 grams (3 pounds). A female, shot September 30, weighed 1034 grams (2¼ pounds).

In an irrigation ditch leading from a reservoir at Jones' a brood of eight young not yet able to fly was seen swimming on the morning of July 22, 1928. When first disturbed the whole brood left the water and the young birds ran over the sand among the near-by sage bushes. The birds returned shortly to the water and three were shot as they started to go up the bank a second time. One of the remaining young ones jumped back into the ditch, dived, and swam under water, coming up ten meters down the ditch. Two of the young ducks saved as specimens were males which weighed 577.6 and 651.2 grams. The other, a female, weighed 544 grams. A lone adult female was flying about and over the near-by reservoir.

Several broods of mallards were present in late July, 1928, on a slough in a hay field near Red Rock P. O. One female that was flushed from the water in a pool flew in circles half a mile in diameter for several minutes, keeping up a continuous clucking. Once, three mallards that could fly well and three that could fly but, apparently, were able to raise their bodies only high enough to clear the grass, were flushed from a pool in a slough. In another pool five small downy young were swimming together, July 24. When approached closely all of them dived but came up again within two or three meters.

On June 8, 1929, four or more mallards were seen on the marshy portion of Petes Valley. Twice pairs were flushed. Once a female flew up and fluttered off slowly and with great commotion through the grass and shallow pools of water. The bird returned and flew around the observer in small circles, apparently greatly concerned. A close search of all the nearby grass clumps failed to reveal either eggs or young birds.

Townsend (1887, p. 193) found a mallard's nest, June 27, 1884, "of eight eggs, in the middle of a grassy plain near Eagle Lake."

Chaulelasmus streperus (Linnaeus)

Gadwall

Two gadwalls that were shot on the morning of October 27, 1923, at the mouth of Pine Creek on Eagle Lake were the only ones recorded in the section.

Mareca americana (Gmelin)

Baldpate

This duck was reported to be common in winter in the vicinity of Red Bluff. At the edge of a pond five miles north of Fredonyer Peak, 5700 feet, a male (saved as specimen) and a female with four young birds were shot on October 1, 1924, while they were feeding in a compact group. It was thought (Dixon, MS) that these birds comprised a family that was migrating together. At the same pond after an all-night rain thirteen ducks of this species were present in the morning of October 6. Twenty individuals were seen, October 12, 1923, along the tule-lined shore of Eagle Lake near Spalding's.

"Observed regularly [in winter of 1883] in the sloughs south of Red Bluff" (Townsend, 1887, p. 194).

Dafila acuta tzitzihoa (Vieillot)

American Pintail Duck

Reported as present in winter in the vicinity of Red Bluff in small numbers. This species was observed by us previous to 1928 at the following stations: Eagle Lake Resort, 5200 feet, May 20, 1925; Spalding's, 5200 feet, May 25 and 26, 1925, and October 12, 1923; five miles north of Fredonyer Peak, 5700 feet, October 1, 1924. Not more than fifteen birds were seen at these places in any one day, and usually only a single pair was seen.

In 1929, several pintails were seen, June 24, at first in a marshy place, then in open water at Feather Lake. On June 24, in late afternoon on a small lake northwest of Butte Lake a female was swimming in company of a female Barrow golden-eye. The pintail quacked loudly when the birds were approached.

Many pintails were found, July 26, 1928, in a flooded hay meadow along Red Rock Creek four miles northwest of Red Rock P. O. This species was the most common one in the colony of ducks breeding at that place. It was estimated that fifty were seen during a morning's observation. Females with broods of young were in sight almost continually. They were swimming in shallow pools or running through the grass and sedges on wet ground. The adult birds flushed singly or in small groups, sometimes keeping close and flying in small circles, possibly thus indicating that young were near. One brood of downy young was swimming in an open pool.

An adult female that was shot near Red Rock Creek was seen hiding in the grass after a short run. When the collector stooped to pick up this bird another one was seen also hiding less than one-half meter from the one that had been shot. Although there was no cover for it, this last bird kept quiet and allowed itself to be picked up. It proved to be a nearly grown young female, weighing 556.5 grams. The adult weighed 611.3 grams.

Nettion carolinense (Gmelin)

Green-winged Teal

A single pair was observed, May 20, 1925, close to Eagle Lake Resort, and three other birds were seen on October 12, 1923, among tules close to the shore of Eagle Lake near Spalding's.

Seen on two or three occasions at Red Bluff in winter of 1883 (Townsend, 1887, p. 194).

Querquedula discors (Linnaeus)

Blue-winged Teal

On the Hickman ranch, one mile above Payne Creek P. O., 1600 feet, four birds of this species, in a group, were seen, June 5, 1924, on the creek (Hunt, MS). This identification is attested by a drawing of the head markings of the male made by the observer at the time.

Querquedula cyanoptera (Vieillot)

Cinnamon Teal

One specimen, a male, was collected on May 22, 1925, near Eagle Lake Resort, 5200 feet. Two cinnamon teal were seen May 14, 1924, on the Sacramento River near Tehama.

On June 18, 1928, a pair was seen in an irrigation ditch at Red Rock P. O. Along Red Rock Creek, four miles northwest of Red Rock P. O., on July 26, 1928, this species was the second most common duck in the hay field where water was standing. The birds were swimming mostly in small open pools. Some were flushed where the grass was thick. This duck was seen mostly in two's and small groups; a few, singly.

In the summer of 1905, Sheldon (1907, p. 186) found "several flocks" at Eagle Lake, as also three nests, on the northwest side of the lake in a grain field, "with 7, 8, and 10 eggs, respectively."

On June 8, 1929, two birds of this species were seen together to make a short, hurried flight in the marshy cañon of Petes Valley. Calls from these birds were heard several times.

Spatula clypeata (Linneaus)

Shoveller Duck

Two were preserved as specimens out of five shovellers that came, October 6, 1924, after an all night rain, to a pond five miles north of Fredonyer Peak. At least fifteen individuals were observed, October 12, 1923, among tules at the edge of Eagle Lake near Spalding's.

A pair was seen, June 18, 1928, in an irrigation ditch at Red Rock P. O. On July 26, a female was seen swimming in an open pool of water in the valley of Red Rock Creek four miles northwest of Red Rock P. O. This one swam off into the vegetation bordering the pool.

Weights in grams of the male and female that were shot were 654 and 483, respectively.

Aix sponsa (Linnaeus)

Wood Duck

Present throughout the year along the lower courses of small streams close to the Sacramento River, as also on that river itself. A specimen was preserved from Dale's, 600 feet. Additional localities where this species was observed are: Red Bluff, 300 feet; Cone's, 270 feet; Bloody Island, 350 feet.

Along the Sacramento River this duck was usually flushed from beneath willow-grown banks. At Cone's the little stream where wood ducks were seen December 29, 1927, ran deep and rather slowly and was densely bordered and in places arched over with willows, grapevines and the other vegetation which usually accompanies these plants.

Rising wood ducks, after being flushed, attracted the observer's attention by one of their number giving a short series of clucking flight calls.

In the stomach (proventriculus) of a female that was shot, December 26, 1924, near Dale's, there were bits of green leaves and one whole acorn of the valley-oak, 40 by 16 millimeters in greatest dimensions. In the gizzard were gravel and bits of acorn shell (Grinnell, MS).

Wood ducks in our section were most often encountered singly or in pairs, although flocks of as many as fourteen birds were seen in winter (December). When pairs were flushed the female was almost invariably leading in the flight.

Townsend (1887, p. 194) saw the wood duck "in April and May [1884] at Red Bluff, where it frequented the sloughs in the timber belts along the Sacramento River"—thus then quite as now.

A male was seen, April 6, 1928, to fly to a high limb of a sycamore on a creek at Cone's and to perch there crosswise for several minutes. A female that was swimming down a slough at Silva's in mid-afternoon, April 12, 1928, continually gave high calls, of single notes of varying tone, some clear and some rasping. After going more than one-fourth mile the bird took to flight toward the main river. It was thought possible that this bird had just left her nest. Another duck flew up just below that place.

At the east side of Bloody Island, on Battle Creek near its mouth, a female with ten young was seen May 26, 1926, that was swimming and feeding along the bank in a fringe of water plants. On the next day, two females, each with a brood of small young, were seen in the same portion of that stream. These two broods were swimming only fifty meters apart (Linsdale, MS).

Nyroca affinis (Eyton)

Lesser Scaup Duck

Observed on Eagle Lake near Spalding's where twelve were seen, October 12, 1923, along the tule-lined lake shore. One was shot, October 22, 1924, at the same station, but it was not preserved.

Nyroca collaris (Donovan)

Ring-necked Duck

On October 13, 1923, a female was shot out of a group of three ducks at the mouth of Pine Creek near Spalding's, but the skin was not saved. A male was preserved October 15 from the same locality. This bird, in-the-flesh, weighed 733 grams.

In the summer of 1905, Sheldon (1907, p. 187) saw many ducks at Eagle Lake, "in pairs, or old with young; always close to shore and not as shy as other ducks; inhabits the lake margins where many dead trees lie in the water. Often seen perched on limbs of dead pines above water." Although these birds were, at the time, thought to be ring-necked ducks, Mr. Sheldon has written to us (letter of July 13, 1929) that he now thinks they were more likely buffle-heads, which species has since then been found breeding at Eagle Lake.

Nyroca americana (Eyton)

Redhead Duck

Two specimens were preserved from near Spalding's on Eagle Lake (May 18, 1925, and October 13, 1923). The male shot in May weighed three pounds. The male that was shot in the fall was very fat and weighed 1070 grams. A pair of redhead ducks was observed on May 24, 1927, in a marshy tract near the shore of Wilson Lake.

All the morning of June 24, 1929, a single male redhead duck was swimming out in the open water of Feather Lake. The bird dived a few times. For a time it swam with head tucked back, evidently asleep. Once a coot came along and chased the duck which retreated but the intruder soon moved off to another part of the lake.

Nyroca valisineria (Wilson)

Canvas-back Duck

Recorded only from Eagle Lake near Spalding's where specimens were collected on October 20 and 23, 1923. Weights in grams of three males collected on those dates were: 1030, 1122, 1136. A female weighed 857 grams. In the summer of 1905, Sheldon (1907, p. 187) noted one individual on Eagle Lake.

Glaucionetta islandica (Gmelin)

Barrow Golden-eye Duck

On June 13, 1926, a female Barrow golden-eye with a brood of eight small young was seen on a small lake close to Butte Lake. One of the young birds that was collected weighed 43 grams (Linsdale, MS).

In the evening of June 24, 1929, a female, but no young, was seen on this same lake. On the same afternoon three females together and one a little apart from them swam out from the shore or near the shore on the southwest side of Butte Lake as an observer passed near by. On the next afternoon a lone female was seen perched on a log which projected above the water in Butte Lake.

At Lake Caribou on June 23, 1929, a male was seen swimming in open water in company of a female American merganser. On a similar sized lake, in which there were aquatic plants, one-half mile away, two males were swimming together (Linsdale, MS).

The first birds noted on Butte Lake (fig. 77) when it was visited on June 26, 1928, were two adult golden-eye ducks, brown-headed ones, very solicitous and thought to have young in the willows margining the western end of the lake. On the next afternoon one was seen several times. Once it suddenly appeared in flight and lit in the water with several low *clucks* or deep *quacks*; again it preened on a log floating at the shore.

On the morning of June 29, two hours were spent watching two adult golden-eyes. The two birds looked to the observer to be in every respect in the same plumage and both were thought at the time to be females. The birds were devotedly attendant upon one another, so that the possibility suggests itself that one of them was a male in eclipse plumage. Now and then one or the other or both would launch into high, wild flight out over the lake and back through the woods, circling thus several times, before splashing into the water again. They were always near to one another and gave a subdued clucking, *kŭk, kŭk, kŭk,* rapid, long continued, and with rising and falling intensity. In flight each "whistled" with the wings, the sound from one bird slightly higher pitched than that from the other. Once in a while, one flying past the other on the water gave a coarse, guttural call. When swimming near one another each did much bobbing of the head, up and forward and back again.

Twice, one went to the top of a rotten stub six meters tall standing in the edge of the lake and with a green willow clump on the landward side. Each time, the bird came to the stub at the end of a long circuitous flight out over the lake, but each time, on barely alighting, with loud flapping of the wings, on the broken top, it flew off again. Presently, each flew up into living lodgepole pines at the end of the lake, and after several attempts lit on a branch, five to eight meters above the ground. If unsuccessful in gaining a balanced footing, the bird would fly off for another circuitous flight, or to drop on the water for a period of diving.

Once, both birds came out on land, on a little grassy place within eight meters of where the observers were seated. They did not eat anything, but kept stepping about, billing one another. Now and then one would stretch its head high up above the level of the grass to look about. Just the relation of this behavior to the breeding cycle could not be determined by the observer (Grinnell, MS).

On the evening of June 28, 1928, a brood of nine ducklings, with an old bird described as exactly like the golden-eyes, previously seen, was reported by a local observer as seen at the other end of Butte Lake.

Charitonetta albeola (Linnaeus)

Buffle-head Duck

Specimens preserved from: Eagle Lake Resort, 5200 feet, June 30, 1925; Gallatin's, 5200 feet, May 28, 1925. Adults observed, May 18 and 24, 1927, on Wilson Lake, 5100 feet, and June 23 and 24, 1929, on Feather Lake, 5500 feet.

In the vicinity of Eagle Lake this duck seemed to prefer a feeding ground in the shallow ponds that were cut off from the lake when the level of the water was lowered. On May 18, 1927, four pairs of the buffle-head could be seen at one time on Wilson Lake. Each pair kept to itself, mostly swimming and diving, but occasionally taking wing to circle about low over the water or to fly from one cove to another.

For several days in May, 1925, a female and male fed together in one of the small ponds close to Eagle Lake. After May 20, the female appeared for a short time in the morning and late afternoon, when she fed while the male kept near. Then both birds would leave, the female leading. Two males were seen pursuing one another on the lake on June 4, but no male was observed there later than that. On May 28, 1925, a female was shot on one of the small ponds, whose manner of feeding and preening indicated that it had just left a nest (Dixon, MS).

Several articles have appeared in *The Condor* which have dealt with the occurrence of young buffle-heads on Eagle Lake. (See: Dixon, 1921, p. 165; Ray, 1921, p. 192; Brooks, 1922, p. 25; Labarthe, 1922, p. 68; Dixon, 1926, p. 47.) Our own findings are essentially as follows.

On June 22, 1921, a female, with two young about one-third grown, was seen in some tules on Eagle Lake. Two days later, at the same locality, another female, accompanied by eight half-grown young, was seen. On June 30, 1925, a family of buffle-heads consisting of an adult female and six half-grown young was seen, also at Eagle Lake. On the same day, a female with four half-grown young (nos. 45960–64) was collected there. These downy young, upon which feathers were beginning to show on the wings and back, were feeding in a shallow arm of the lake where there were many aquatic plants and an abundance of insect food. The ducks were feeding on the insects, as a subsequent examination of the contents of the stomachs showed. In each of the five stomachs Corixidae and naids of damsel flies (Zygoptera) were present in nearly equal amounts and together made up from 80 to 90 per cent of the whole content. Sand made up around 10 per cent of the content in each. One stomach contained some backswimmers (Notonectidae), in two there were annelid worms, and in another, twelve unidentified seeds. Thus, the food of this brood, together with the parent, consisted of nearly 100 per cent animal matter. Most of the insects were such as had to be secured in the shallow water, and mostly by diving.

Weights in grams of the four young birds of this brood were as follows: 145, 162, 168, 170. The adult female was recorded as weighing only 279 grams.

The young birds in this case apparently paid no attention to an alarm note which the parent gave when the collector approached them. Other broods that were observed were always led to the tules by the female so that they soon escaped (Dixon, MS).

On the evening of June 23, 1929, a female followed by six downy young was seen out on the open water of Feather Lake. The whole group swam off in single file, the parent leading. A family, probably the same one, was seen on the next day on another part of the lake (Linsdale, MS).

Erismatura jamaicensis rubida (Wilson)

Northern Ruddy Duck

One that was shot October 1, 1924, five miles north of Fredonyer Peak, 5700 feet, was preserved as a specimen. Six others were seen at the same pond on October 6. On May 24, 1927, at Wilson Lake, 5100 feet, three brilliant males and other individuals of less brilliant colors were seen out in grassy tracts in the shallow lake. Others were seen there on June 15, 1928. Near Spalding's October 12, 1923, and October 22, 1924, groups of up to twenty-five birds were seen along the shore of Eagle Lake. Ten were seen September 28, 1924, at the north end of Eagle Lake.

The single specimen obtained, a male, weighed 528 grams.

Mergus americanus Cassin

American Merganser

Specimens collected at Dale's, 600 feet, January 14, 1925, and near Eagle Lake Resort, 5300 feet, May 21 and 22, 1925. Observed also at the following additional localities: Red Bluff, 300 feet, May 13, 1924; Battle Creek Meadows, 4800 feet, May 31, 1926; Butte Lake, 6100 feet; Lake Caribou, 6000 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet. Twenty mergansers, mostly young, were seen September 28, 1923, at the north end of Eagle Lake.

Two full-plumaged males of this species were watched, May 14, 1924, that were swimming together in backwater at the mouth of a slough along the Sacramento River. A female that was preening when first sighted was seen on a snag in the river near Red Bluff. When disturbed by a boat floating down upon it, this bird waddled off into the water and gave a few subdued quacks. The species thus probably breeds along the Sacramento River. The single merganser that was seen on Battle Creek Meadows was a female that was flushed from a little stream in thick willows (Grinnell, MS).

As the water in Eagle Lake receded it left at a place on the west side several isolated ponds back in the woods. These ponds were crowded with aquatic vegetation and, in May, 1925, were partly dried out. American mergansers fed regularly at these places.

An adult female from Dale's (January 14, 1925) weighed 1136 grams (2½ pounds) and one from Eagle Lake (May 22, 1925) weighed 1034 grams (2¼ pounds).

A male merganser was watched, June 1, 1925, resting on a rock that projected out of the water at the edge of Eagle Lake. While it was thus resting a cormorant came along and drove it off the rock. The duck moved on a short distance to another rock and resumed its sleep (Dixon, MS).

At the season when the females were with broods of young, males of this species at Eagle Lake were observed (May 24, 1925) to keep together in groups of up to eight individuals. One month later (June 26) no males could be found in the same place although a search was made for them (Dixon, MS).

Female mergansers that were thought to be brooding were observed, between six and eight o'clock in the morning, to gather into groups of from two to four individuals to feed. After feeding, these birds would fly about through the timber bordering the lake, meanwhile keeping up a continuous hoarse *cŭck, cŭck, cŭck,* uttered at regular intervals of one-half second (Dixon, MS).

One female that was watched (May 25, 1925) lit on a broken-topped dead yellow pine (fig. 125). At first she remained perched, parallel to it, on one of the larger limbs eighteen meters above the ground. Then at intervals of from ten to fifteen seconds she uttered the warning cry, *cŭck, cŭck, cŭck, cŭck,* three or four times in succession. Then the bird would crane its neck and peer about much as does a cormorant. It then fluttered up to the broken top of the stub, flew away and, after circling a few minutes, returned to the same stub. She left and returned to this stub four times within half an hour. On each trip the bird inspected some part of the dead tree, walking along the larger limbs with apparent ease and turning around on them without difficulty (Dixon, MS).

Near Eagle Lake Resort, on the afternoon of June 11, 1929, two single females were perched on rocks along the edge of the lake. When the birds were approached, each one gave low calls and went out into the lake; one flying and one swimming. An hour later one bird, at least, was back on a rock. Several times in the early morning of June 12, a female was seen in circling flight over and among the trees back from the lake. In the early afternoon of that day a male and two females were seen together in the lake near the shore.

At eight o'clock in the morning of May 19, 1925, a female merganser that was being watched in a pond at the edge of Eagle Lake flew up, calling constantly, and circled about and through a strip of dead timber. After circling one large broken-topped dead pine four times the bird lit in the very top, the stub being hollow. The bird went into, and remained in, this hollow where, apparently, it had a nest. Pounding at the base of the stub was not sufficient to make this individual leave. The hollow stub at the top of the tree was over twenty-five meters above the ground (Dixon, MS).

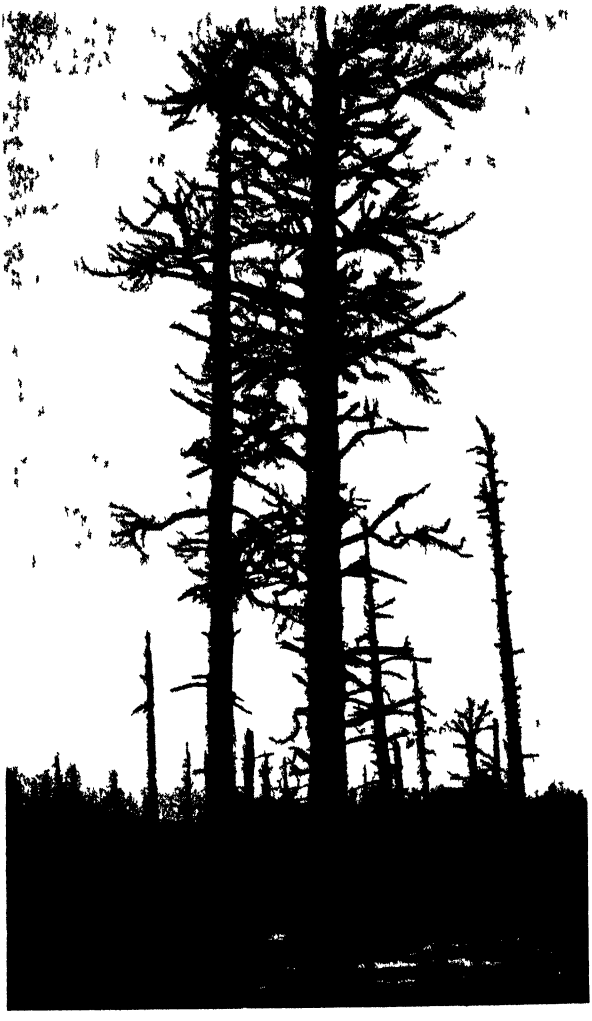


Fig. 125 A tree (at right) in the stub forest, in a hollow at the top of which was situated a nest of the American merganser (*Mergus americanus*) Photograph taken May 19, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4621

Four young mergansers out of a brood of thirteen that was with an adult female in a shallow inlet of the lake were obtained on May 21, 1925. The parent kept out of gun range and the other young ones swam off into some tules. The adult did not return until after at least twenty minutes. On the next day another young bird was collected along with the adult female. The weights in grams of the five young were: 49, 50, 58, 59, 65. In the young the color of the iris was gray; the feet, olive; the bill, blackish brown. It was noted that in these youngsters the feet and oil sacs showed special development, in contrast with the wings which were weakly developed. In other words, the structures which can be assumed to be of immediate use in early life were most developed at that time, while development of certain other structures of need later was retarded.

The gullets of two of these ducklings which could have been scarcely one week old contained small fish from twenty to thirty-two millimeters in length (Dixon, MS).

On June 22, 1921, a female American merganser was noted near the southwest shore of Eagle Lake, with five half-grown young in tow.

On June 17, 1928, at the north end of Eagle Lake, a female was seen twice with twenty-one small young. When approached the second time over the beach terraces from the land side, the entire brood and the closely accompanying old bird jumped from a flat rock in the surf on which they had been resting and scrambled over the water's surface, in a line abreast, far out into the lake. The spray thrown up by the moving line of birds could be seen after they were too far from the shore to be made out individually. The large number of young in this instance may have resulted from one female caring for the young hatched by two mothers in two separate nests. This supposition received support by observation the next day, a quarter of a mile farther along the lake shore, of an adult female on a sandbar in company of two old males but no young (Grinnell, MS).

Young of this species were seen on Eagle Lake in late June of 1884, by Townsend (1887, p. 193).

Cathartes aura septentrionalis Wied

Northern Turkey Vulture

Well distributed over the section in summer. Found in winter only down near the Sacramento River. Observed at the following stations: Blue Tent Creek, 300 feet, January 2, 1928; Red Bluff, 300 feet; Coyote Creek, 270 feet, December 28, 1927; Cone's, 270 feet, December 29, 1927; Bloody Island, 350 feet; Tehama, 250 feet, December 28, 1927; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet.

Turkey vultures were seen usually in flight, but on a few occasions individuals were observed perched on the ground, on fence posts, or on limbs of living or dead trees (fig. 51).

A turkey vulture was caught, May 19, 1924, by the foot in a steel trap that had been set for coyotes at Dale's. The bird was dead when taken from the trap; possibly heat from the sun had killed it. The bait at this setting was buried except for a few small bits scattered near the trap.

A turkey vulture was watched, April 11, 1928, that perched in the top of a medium-sized blue oak during a light rain of brief duration. For a few minutes after the rain stopped the bird held its wings partly spread, possibly to hasten the drying of the feathers. One group of ten or twelve individuals was observed perched in the tops of dead trees. These birds at intervals, shortly after 8 a.m., spread their wings and tails, holding them so that the sun shone squarely upon them.

In December and January, 1927–28, the presence of many turkey vultures in the Sacramento River bottom was notable, because of this being so northern a station for the species to occur in winter. On December 28, from the bridge at Tehama, thirteen of the birds were counted in sight at once by one observer, thirty of the birds by another observer—all in circling flight.

Gymnogyps californianus (Shaw)

California Condor

No trace of this vanishing species was found by us anywhere in the region. However, Townsend (1887, p. 201) makes the following statements concerning it, which, we think, warrant us in entering its name here. "In 1884 a hunter at Red Bluff told me that he had killed a vulture of immense size in the southeastern part of Tehama County two or three years previous, and that he had seen others in the foothills southwest of Mount Lassen within the last four or five years. As this is all the information I could obtain with regard to this species, it has probably almost disappeared from Northern California, where it was once certainly common."

Earlier, Newberry (1857, p. 73) stated that, in 1855, "A portion of every day's experience in our [his] party's march through the Sacramento valley was a pleasure in watching the graceful evolutions of this splendid bird. . . . . After we left the Sacramento valley [via Fort Reading], we saw very few in the Klamath basin. . . . . "

Elanus leucurus majusculus Bangs and Penard

North American White-tailed Kite

Entered here only on the basis of the statement by Townsend (1887, p. 201) that he saw it at Red Bluff, "where two individuals appeared early in May," 1884.

Astur atricapillus (Wilson)

American Goshawk

One was seen and heard calling vigorously on May 20, 1927, in a heavily wooded cañon at 5400 feet, two miles northwest of Mineral. Another or the same bird was seen close to Mineral, 4900 feet, on May 25. On June 28, 1929, one flew out from small conifers bordering Rock Creek near where it crosses the Mineral–Viola road. The bird flew within five meters of the ground and kept below the line of the tops of the trees. On August 1, 1925, two goshawks were watched, one following the other and yelping loudly, that lit in the upper branches of a red fir on the side of a ridge at 8000 feet toward Lassen Peak from Soupan Springs. Our own only other record for this species in the section was of one observed June 28, 1925, near Gallatin's, 5200 feet.

Mr. A. H. Kramer, who was stationed several seasons on the summit of Prospect Peak, as a fire lookout, shot, about August 1, 1927, one of these hawks that had just killed a golden-mantled ground squirrel and was pursuing another one near the station. Two of the tail feathers of this bird were sent to the Museum of Vertebrate Zoology where the identification was confirmed by comparison with complete specimens.

In the collection of the California Academy of Sciences is a bird-of-the-year (no. 26437) taken at the Bogard Ranger Station, 5500 feet altitude, September 8, 1923.

A female was obtained in the latter part of June, 1929, by Professor Loye Miller at the southwest end of Eagle Lake. Both the behavior and the appearance of the bird indicated that it had just come from a nest in the vicinity.

From the above data it is concluded that the goshawk is resident, though rather sparingly, in forested portions of the Canadian life-zone.

Accipiter velox (Wilson)

Sharp-shinned Hawk

Specimens of this hawk were obtained at the following stations: seven miles east of Red Bluff, 700 feet, December 30, 1927, and April 11, 1928; Inskip Hill at 1800 feet, December 22 and 23, 1927; Spalding's, 5200 feet, October 26, 1923. Additional records based upon sight identification are: six miles northeast of Red Bluff, January 2, 1928; Mineral, 4900 feet, May, June, and July; Kelly's, 5200 feet, September 2, 1925.

Two females collected in the section weighed 200 and 205 grams, respectively.

A sharp-shinned hawk that was shot seven miles east of Red Bluff on April 11, 1928, was carrying a valley quail which it had been eating. A passing automobile disturbed the hawk at the side of the road. It could barely lift its burden over a rock fence that paralleled the road and when over the fence it dropped with its burden immediately to the ground.

The stomach of one of these hawks shot at Eagle Lake contained remains of a Savannah sparrow. One was seen northeast of Red Bluff carrying a bird that appeared to be a spotted towhee, disappearing with it beneath a manzanita thicket. Apparently the chaparral-covered slopes of Inskip Hill furnish in winter good hunting territory for this hawk since several were killed there in December. At that season the birds showed a ready inclination to make use of sound in locating prey. On at least five occasions when a collector was attempting to entice small birds from thickets by making a squeaking sound, a hawk chancing to fly by would change its course and fly directly toward him as if expecting to locate quarry.

With no doubt whatsoever sharp-shinned hawks were nesting in the vicinity of Mineral, where during May, June and July, individuals were seen again and again in the upper portion of Battle Creek Meadows, 4900 feet, as well as up the Viola road and up the Broke-off trail, in each case to about the 6000-foot level. Members of one pair clearly centered their interest within a dense tract of lodgepole pines and white firs adjoining an alder swamp close to the Forest Service Camp Ground east of Mineral. Either the male or the female would be seen in beeline flight through the woods about half tree-height above the ground. Some hours of watching failed of locating the focus of these flight lines, though they were so regular on June 15, 1925, as to convince the observer that a nest nearby then contained young (Grinnell, MS).

In December no sharp-shinned hawks were seen above the 3000-foot level.

Accipiter cooperii (Bonaparte)

Cooper Hawk

A single specimen was obtained on December 27, 1927, from the east side of Inskip Hill at 2000 feet altitude. Recorded by observation from: six miles north of Red Bluff, April 8, 1928; Cone's, 270 feet, April 17, 1929; Dale's, 600 feet, May 31 and December 21, 22 and 29, 1924; Manton, 2300 feet, April 18, 1928; Mineral, 4900 feet, on several days in July; Kelly's, 5200 feet, September 2, 1925; Butte Lake, 6100 feet, June 15, 1926.

The bird collected, not sexable but obviously a male, weighed 305.5 grams.

At Dale's, on December 22, a Cooper hawk captured a California woodpecker. In the neighborhood of Mineral, in the summer of 1925, individuals of this hawk were seen or heard so regularly in a certain tract of white firs adjoining Battle Creek Meadows that rearing of young was believed to be under way there.

In 1905, on August 4, Sheldon (1907, p. 187) obtained a specimen of this hawk at Eagle Lake.

Near Cone's, on April 17, 1929, a Cooper hawk flew in among the branches of the top of a large valley oak. At the same time a flock of goldfinches flew out from the tree. The hawk appeared not to check its flight in moving among the branches.

Buteo borealis calurus Cassin

Western Red-tailed Hawk

A resident in the entire section; of common occurrence and uniform distribution over the western one-half, but found to be scarce in the eastern portion. Specimens were obtained six miles north of Red Bluff and at Dale's, 600 feet. This species was encountered from the low ground in the Sacramento River valley to the highest point in the section, namely, the summit of Lassen Peak (two seen circling overhead, September 11, 1923—J. Dixon). Stations of observation to the eastward of Lassen Peak were as follows: Feather Lake, 5500 feet; Eagle Lake Resort, 5200 feet, May 14, 1925; Spalding's, 5200 feet, June 16, 1928; eight miles southwest of Ravendale, 5600 feet, July; Termo, 5300 feet, October 12, 1924; Secret Valley, 4500 feet; Dransfield's, 5300 feet, January 8, 1926; Red Rock P. O., 5300 feet, June and July.

Weights of two adult females from the section were 2½ and 3 pounds, respectively.

At Elliott's on April 14, 1928, a red-tail's nest was seen on a small shelf of a west-facing cliff, fourteen meters above its base. An adult that was on the nest flew off when approached closely and circled over the near-by valley and kept calling persistently as long as the observer remained in the neighborhood.

Townsend (1887, p. 202) obtained a set of four eggs at Red Bluff, April 1, 1884, from a nest twenty feet above the ground in "the forks of a scrubby oak."

In 1905, Sheldon (1907, p. 187) found a nest of this hawk in a pine on the northwest side of Eagle Lake. There were two half-grown young in this nest on July 7.

On June 16, 1929, a nest was found halfway up the cañon side on the west of Secret Valley Creek. The site was the highest crotch ten meters up in a large juniper tree. Both adults were perched in a near-by juniper. When approached the birds circled and called loudly. At least two well-feathered young hawks were standing up in the nest. Possibly there were others down out of sight.

Buteo lineatus elegans Cassin

Red-bellied Red-shouldered Hawk

Limited in the section to the low, timbered ground immediately bordering the Sacramento River and its tributaries, where apparently a resident species. Observed at the following places: Silva's, 270 feet, April 13, 1928; Tehama, 250 feet, May 14, 1924, and December 28, 1927; Cone's, 270 feet, December 28, 1927. Except one that was flushed from a line of cottonwoods, all the individuals seen, and in spring heard were circling over groves of valley oaks (fig. 50).

Buteo swainsoni Bonaparte

Swainson Hawk

An adult male shot, July 20, 1928, near Red Rock P. O., weighed 566 grams.

Individuals of this species were observed flying over the blue-oak covered hills north of Red Bluff on April 23, 1928, and May 8, 1924. These birds, apparently in transit, were circling and moving in general toward the north. Two were observed in Grasshopper Valley, June 18, 1928. One was seen in flight eight miles southwest of Ravendale on July 18, 1928. On May 19, 1918, a pair that perched on fence posts at the side of a road near Termo, 5300 feet, allowed an automobile to pass them within ten meters.

Several were observed July 20, 22, and 27, 1928, and June 18, 1929, in the eastern part of the Madeline Plains flying over the sagebrush or perching on posts and poles at the roadside. The stomach of the single bird collected as above, was filled with grasshoppers.

This open-country hawk evidently breeds in the Great Basin portion of the section, and occurs west of the mountains only as a transient.

Adults were seen on June 21 and 22, 1929, in the tops of pine trees at the edges of clearings along Pine Creek near Bogard R. S.

Close to Feather Lake, on the evening of June 23, 1929, a Swainson hawk sailed to the ground at the edge of the timber where it caught an Oregon ground squirrel. Then the bird started to fly across the lake with its catch, but some black terns flew after it and worried it so that it dropped the animal in the middle of the lake. Later the terns were seen flying at this bird as it perched in the top of a large yellow pine.

Townsend (1887, p. 202) states that he found this hawk frequently in summer "in the pine country about Mount Lassen," and he took a specimen there July 1, 1884. Even though we ourselves did so find it only once, over the top of Lassen Peak, July 26, 1929, the well known propensity of this species elsewhere to go higher than its breeding zone, to forage for grasshoppers in mountain meadows, makes Townsend's statement fully credible. But that the Swainson hawk winters commonly in the Sacramento Valley, as Townsend also states, is not consistent with our other knowledge and is to be doubted. He took specimens at Red Bluff, April 10 and 18, 1884, which is the normal time for migration through western California.

Buteo lagopus sancti-johannis (Gmelin)

American Rough legged Hawk

A female, in light phase of plumage, that was flying over a meadow near Dransfield's, 5300 feet, on January 3, 1926, was collected. The bird weighed 1293 grams. Single individuals were observed in the same neighborhood on several days later in the same month.

Buteo regalis (Gray)

Ferruginous Rough-legged Hawk

On January 7, 1929, a ferruginous rough-leg was seen flying over a stubble field adjoining Coyote Creek, south of Red Bluff. In the afternoon of the same day another individual was seen on the east side of the Sacramento River, eleven miles southeast of Red Bluff. When first seen this bird was on a fence post at the roadside. It then flushed and alighted on the ground out in a field.

Aquila chrysaëtos (Linnaeus)

Golden Eagle

A sparse resident in the section. Observed at the following localities: Dale's, 600 feet, May 22, 1924; Payne Creek P. O., 1600 feet, December 19, 1927; Butte Lake, 6100 feet, June 20, 1926; Dransfield's, 5300 feet, January 4, 1926; Red Rock P. O., 5300 feet, July 23, 1928; Box Springs, 5300 feet.

A nest of this species was seen close to Box Springs. It was firmly imbedded among the upper branches of a large yellow pine with a divided top that stood in a grove of thirty-five pines on a sandy hill among sand-dunes. When examined, October 17, 1924, the nest appeared to have been in use for many seasons (Dixon, MS).

Haliaeëtus leucocephalus leucocephalus (Linnaeus)

Southern Bald Eagle

Found by us in the vicinity of Eagle Lake at Spalding's, in May and June, and at Gallatin's, in June. Observed once near Snag Lake, 6100 feet, June 25, 1929.

On May 18, 1925, a nest of the bald eagle was found in a giant dead yellow pine on the western shore of Eagle Lake (fig. 126). The nest was saddled in a crotch of the tree at a height of at least thirty meters above the ground. Attention was directed to the nest by hearing the chuckling alarm note of the female eagle at the nest tree when the observer was yet half a mile away. Both birds of the pair stayed in the neighborhood of the nest; but the female, as determined by her much larger size, kept closer and appeared to be more concerned when a person approached the home. There were two young eagles in the nest on that date.

A pair of ospreys occupied a nest within 100 meters of the eagles' nest. While the ospreys feared the female eagle and always retreated before her, they spent a considerable amount of time each day in pursuing the smaller male. The male eagle attempted no defense but escaped by practicing an erratic mode of flight, changing his course after each one hundred meters or so.

The nest was watched during a thunderstorm when there was a hard rain, but the parents made no effort to shield the young birds. When the wind was especially strong the female kept a perch near the nest but held her body in a horizontal position rather than in an upright one. Even when heat from the sun was intense, at mid-day, the young birds were left unshaded. When the parents were away, the young called plaintively, but the sounds were weak and could not be heard by the observer more than a hundred meters away.

Once, at six o'clock in the evening, the adult male brought a fish. After circling over the nest twice the bird dropped the fish on the nest, but it rolled off and fell to the ground where it lay unrecovered. The fish was a black bass, 30 centimeters in length.

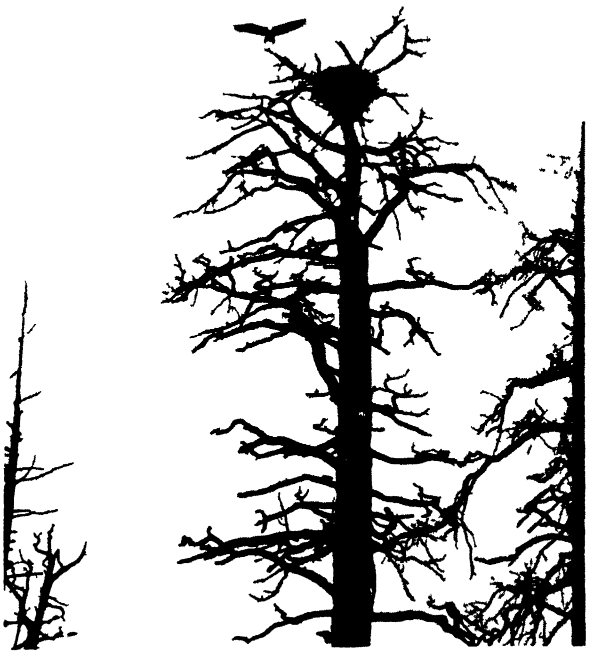


Fig. 126. Nest of southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) in top of tall dead yellow pine in stub forest. Shows female eagle about to alight on a limb near the nest. Photograph taken May 19, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4591.

When the eagles' nest was visited on June 26 the two young were perched on limbs close to the nest, evidently nearly ready to leave their home site; they made no move to fly. On this date both adults appeared to be more timid than they were on previous visits to the vicinity. This time the ospreys were able to put both of the eagles to rout (Dixon, MS).

When this nest was watched on June 13, 1929, two adults were perched at first in the top of the nest tree. The birds stayed in the vicinity, alternately circling about in flight and perching in the top of some near-by stub. The only notes heard were low, chuckling notes. Occasionally one of the birds was pursued by an osprey. No direct evidence of the presence of young birds could be detected. If any were in the nest they kept down out of sight from the ground.

We were informed from several sources that numbers of bald eagles visit the blue oak clothed foothill territory immediately to the east of the Sacramento Valley during the late winter months, December to March, and that in certain years these birds kill many lambs there. Because of this, the eagles are shot or poisoned whenever opportunity permits. We heard of several being killed in the winter of 1927–28, but unfortunately none has been recovered for a specimen.

In the winter of some years, local residents declared, bald eagles have been present on Eagle Lake in much larger numbers than in summer, upwards of 100 having been counted at one time. The birds were said to be then feeding chiefly on coots.

The possibility that these winter-visiting birds belong to the large northern race, *H. l. alascanus,* makes it highly desirable that specimens be obtained for examination.

Henshaw (1879, p. 315) states that in the summer of 1877 he found "American Eagles" numerous about the shores of Eagle Lake. "Rarely disturbed," he says, "they are much less shy than usual, evidence of this fact being apparent in the accessible situations which their nests occupy. Several were noticed in the splintered tops of pines, the low heights and convenient branches of which placed them within easy reach." One nest he visited on "July 10 contained two young, still unable to fly, though in size fully grown."

Circus hudsonius (Linnaeus)

Marsh Hawk

A full-grown young male collected July 21, 1928, at Red Rock P. O. weighed 306 grams.

Three marsh hawks were seen, January 2, 1928, along a half-mile stretch of road six miles southeast of Red Bluff. The birds were flying low and occasionally alighted for brief periods of time on the bare ground or on posts between plowed fields and wet pastures. A single bird was observed on October 12, 1923, along the shore of Eagle Lake.

On July 15, 1928, at 9 A.M., a marsh hawk flew low over the marsh at the upper end of Petes Valley and dropped to the ground where it picked up a meadow-mouse which it started to carry off in one foot. The foot holding the mouse was held downward so that the full length of the leg showed plainly.

Several individuals were present in the vicinity of Red Rock P. O. in late July, 1928, and on June 18, 1929. Both young-of-the-year and adults were seen there in flight over the irrigated hay meadows or sometimes out over the dry tracts of sage-brush. Usually the birds flew close to the ground, but occasionally one soared high in the air.

One was seen in flight, April 17, 1929, over fields adjacent to Coyote Creek.

Pandion haliaëtus carolinensis (Gmelin)

American Osprey

Occurs in summer locally, close to the larger streams and lakes. Observed at the following localities: Red Bluff, 300 feet, May; Cone's, 270 feet, April 6 and 16, 1928; Manzanita Lake, 6000 feet, June 17, 1927; Willow Lake, 5600 feet, July 19 and 21, 1924; Eagle Lake Resort, Spalding's, and Gallatin's, on Eagle Lake, 5200 feet, in May and June of several years, and on October 12, 1923.

On May 25 and June 17, in places where Brewer blackbirds were found living close to ospreys, the latter were almost incessantly pursued and tormented by the blackbirds.

On several occasions when pairs of ospreys were seen together, flights were observed that were thought to be a part of the courtship behavior. One bird in the presence of another would mount into the air and with beating wings pause briefly, then fall for about fifteen meters with set wings, simultaneously uttering a series of shrill cries, not the usual whistles. This performance would be repeated over and over for several minutes at a time. These flights were observed at Red Bluff on May 5 and at Eagle Lake on June 16 and 25.

In June, 1921, twenty-eight nests of this species were counted in a stretch of three miles along the southwestern shores of Eagle Lake (figs. 127 and 128). All except three of these were occupied. It was estimated that between thirty and thirty-five pairs were nesting then around the southwest half of the lake. All the nests observed that season were on dead stubs of yellow pine and from ten to thirty meters from the ground. The birds chose trees for nesting that were around bays and not out on points where the wind would be strong (Dixon, MS).

On June 22, young birds in the nests were sufficiently large that they could hold their heads up over the edges of the nests. When it was hot one parent shaded the young from the sun while the other brought fish.

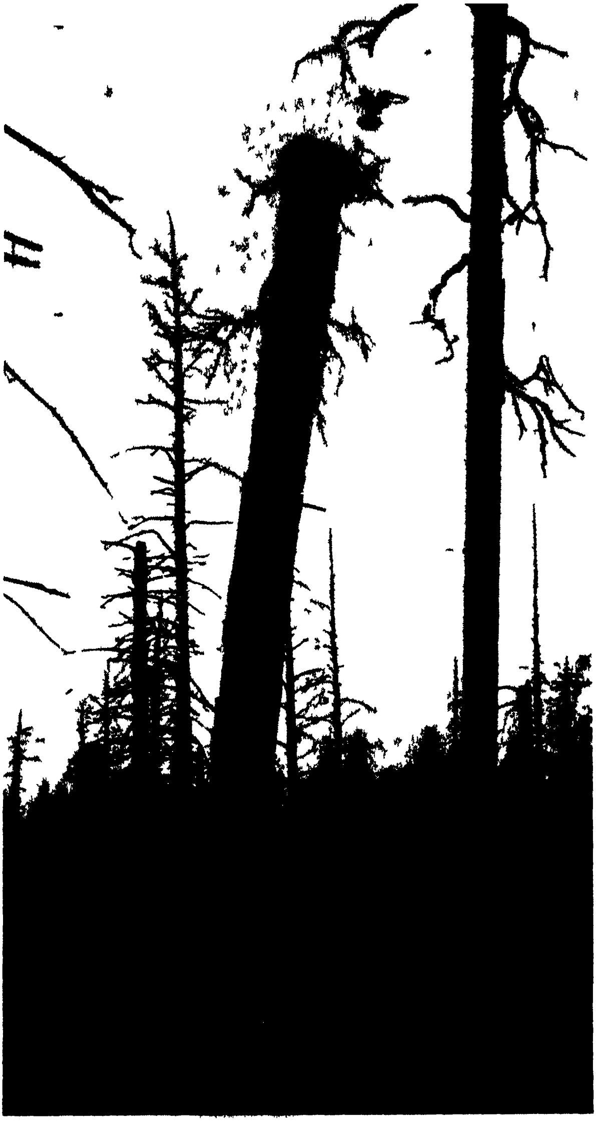


Fig. 127. Nest of American osprey (*Pandion haliaetus carolinensis*) on top of stub at margin of Eagle Lake. Shows adult osprey about to alight on the nest. Photograph taken June 22, 1921. Mus. Vert. Zool no. 3678.

In 1925 the number of nesting ospreys on the lake was as large or even larger than in 1921. Brooding birds were seen on nests on May 14.

Ray (1915, p. 70) has recorded finding, on May 17 and 18, 1914, six osprey's nests at the southwest end of Eagle Lake. These were all in dead trees, then standing in water apparently at a high level. One nest climbed to, contained three slightly incubated eggs. The six nests varied in height above the ground from 35 to 112 feet.

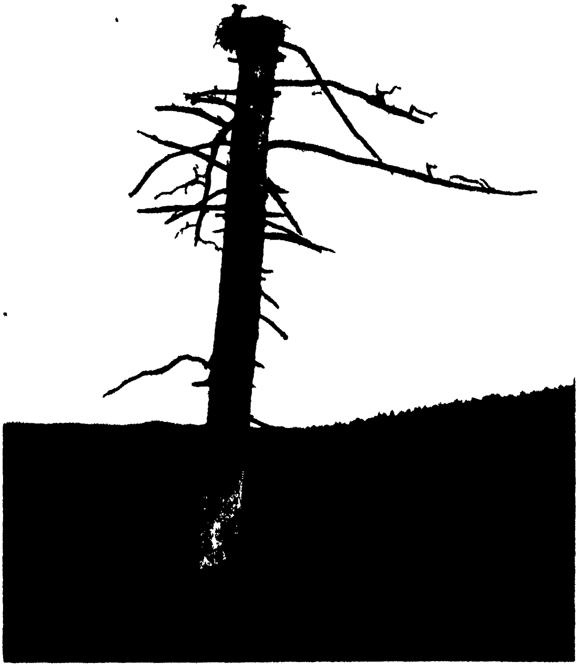


Fig. 128. Nest of American osprey (*Pandion haliaëtus carolinensis*) on top of stub in shallow water of Eagle Lake. Shows one adult on nest and another carrying a fish. Photograph taken June 24, 1921. Mus. Vert. Zool. no. 3672.

A still earlier record is that of Sheldon (1907, p. 187) who, on July 7, 1905, found a nest at Eagle Lake containing one young bird. One other nest is mentioned as having been seen during more than a month spent in the vicinity.

It is probable that at the present time conditions at Eagle Lake are just about optimum for the osprey. At any rate no such numbers of nesting birds as in the 1920's have been reported from anywhere else in California within the thirty years previous to 1929.

Falco mexicanus Schlegel

Prairie Falcon

Found sparingly as a resident at scattered localities within the section. Specimens obtained nine miles east of Red Bluff, 700 feet, December 19, 1927; at Spalding's, 5200 feet, October 26, 1923; near Termo, 5300 feet, October 12, 1924. Single birds were observed at the following additional localities: Red Bluff, 300 feet; Coyote Creek, 250 feet; Dale's, 600 feet; near Warner Creek at 8000 and 9200 feet; five miles north of Fredonyer Peak, 5700 feet; Petes Valley, 4500 feet; Jones', 5400 feet.

An adult male from near Termo, taken October 12, weighed 500 grams.

A great horned owl was trapped at Eagle Lake on October 19, 1923. A prairie falcon that discovered the owl in the trap swooped and struck at the bird repeatedly. Feeding ducks and coots at Eagle Lake appeared to pay no attention to hunting falcons. It was thought that in that vicinity this species hunted for meadowlarks and flickers (Dixon, MS). At a point five miles north of Fredonyer Peak, a falcon was seen chasing a flicker, but the latter escaped into some brush.

Falco peregrinus anatum Bonaparte

American Duck Hawk

At noon on July 27, 1925, two duck hawks were observed in flight at close range about the summit of Broke-off Mountain (fig. 79). They were circling opposite the east-facing declivity, and there was association suggested in the minds of the observers on the summit with the lakes which dotted the landscape below. The fire lookout stationed there had noticed the birds earlier the same day but not on any day previously (Grinnell, MS).

Falco columbarius richardsonii Ridgway

Richardson Pigeon Hawk

This entry becomes justified only on the basis of one bird obtained: no. 45608, female, weight 206 grams; shot by A. E. Borell, September 30, 1924, five miles north of Fredonyer Peak, 5700 feet altitude. The characters by which we identify this specimen as *richardsonii* rather than *bendirei* are as follows: the generally pale, "wet-sand" tone of dorsal brown color; top of head, of pale rusty brown tone with sharp black shaft-streaks, and brow lighter, dull whitish; tail with five distinct light bars in addition to the broadly whitish tipping; light bars on inner webs of primaries extensive; wing 222 mm., tail 135.5.

In this connection, we have consulted Ridgway's *Manual*, 1887, and Taverner's *Birds of Western Canada*, 1926, besides using the Museum series of specimens for comparisons.

Falco columbarius bendirei Swann

Western Pigeon Hawk

Found by us in the section as a transient only, at Eagle Lake and east of there. Specimens were preserved from the north end of Eagle Lake, 5300 feet, September 28, 1924. In addition, the species was observed up the ridge west of Eagle Lake Resort, 5200 feet, May 14, 1925 (*fide* Dixon, MS), and at Termo, 5300 feet, October 12, 1924. The single specimen (no. 45607, female) weighed 227.8 grams.

Observations that were made in the vicinity of Termo in October, 1924, indicated that the population of robins and evening grosbeaks there was the principal source of food for the pigeon hawks of that vicinity that season.

The above cited "sight record" for May 14 is of more than ordinary importance. It is one more of a series of records, of similar nature, of occurrence in the higher mountains of California within the breeding season. To the best of our knowledge, no actual specimen of pigeon hawk has been taken in this state or in Lower California between April 19 and August 28. While nesting of this species in the Sierra Nevada is quite as reasonable, on geographic grounds, as that of the goshawk, Barrow golden-eye duck, and buffle-head duck, further and conclusive evidence of it is required.

Falco sparverius phalaena (Lesson)

Western Sparrow Hawk

A summer resident at scattered localities over most of the section; present throughout the year at western end below about the 3500-foot level; more numerous in winter there than in the nesting season. Specimens represent the following localities: Coyote Creek, 270 feet; Bloody Island, 350 feet; six miles southeast of Red Bluff, 280 feet; Red Rock P. O., 5300 feet. Observed also at the following additional places: six miles north of Red Bluff, 350 feet; Red Bluff, 300 feet; Silva's, 270 feet; Cone's, 270 feet; Tehama, 250 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; four miles southeast of Manton, 3000 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Mineral, 4900 feet; summit of Broke-off Mountain, 9232 feet (July 27, 1925); Lassen Peak at 9500 to 10,000 feet (August 1, 1925); Feather Lake, 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; north end of Eagle Lake, 5200 feet; Petes Valley, 4500 feet (July); eight miles southwest of Ravendale, 5600 feet (July).

Weights of three adult males, collected in April and May in the western end of the section were 86.5, 98.9, and 102 grams. An adult female in July, from Red Rock, weighed 115.2 grams; a female in December, from Coyote Creek, 153.5 grams.

Sparrow hawks were found in such situations as the following: perched on trees, telephone lines, or fence posts at roadsides where these adjoined fields or grassy areas; in tops of trees bordering streams where forage grounds were near; in open stands of blue oak, yellow pine, or juniper.

When foraging the birds either watched the ground from some high perch, or, more often, they flew back and forth over the feeding ground looking for prey on the ground. In midwinter of 1927, individuals hunting over the prairie-land south of Red Bluff would poise on beating wings long at one place, occasionally flying to the ground, and would then make off to repeat. One went to the ground at an angle, without the preliminary poising flight. It went into the air again after a few seconds. The observer could not determine whether the bird had obtained anything on the ground.

One bird watched on April 16, 1928, flew with some object in its claws from the floor of a bridge and carried it to the base of a tree and beneath a brush pile. One sparrow hawk that was shot, May 25, 1926, was in a brush pile close to the Sacramento River, eating a large caterpillar. These definitely recorded instances are exceptional to the usual open-feeding habit of this hawk.

On August 1, 1925, close to timber line on Lassen Peak, four sparrow hawks were in sight most of the day, hovering against the strong south wind. Apparently the birds were attracted there to feed on the grasshoppers then numerous on the gravelly places between the boulders. The larger rocks furnished perching places for the hawks.

At Cone's, on April 6, 1928, a pair of sparrow hawks was watched that had evidently settled to nest in the hollow of a broken limb of a dead cottonwood at the side of a stream. One or the other of the birds was seen in that neighborhood at intervals throughout the day. At one time the female flew out from the hollow, to a perch in a near-by dead tree, where it kept calling for several minutes. The male came and perched for a short time close by; then they copulated, the male flew off and the female went back to the hollow where it stayed as long as the observer kept watch. This was shortly after noon. About six in the evening of the same day these birds were seen copulating again. Sparrow hawks were seen in flight about this nesting tree on April 24. One flew down three times at a crow in a tree before it went off to perch in another dead tree.

Young birds out of the nest were seen in Petes Valley on July 12, 1928.

The availability of suitable hollows for nesting within easy access of the proper type of forage places, as indicated above, seems to be a factor important in influencing the presence locally of this species in the section during the breeding season.

In winter this species is to be encountered in numbers in the lower western end of the section where the preferred food is easily available at that season on open ground; it was not found by us at that season in the other parts of the section where the cover of snow and the low winter temperatures tend to restrict the availability of the kinds of food usually eaten by this bird.

From time to time, as opportunity has offered, the senior author has examined specimens of sparrow hawks from eastern and western North America with a view to seeing if there be grounds for distinguishing a western from an eastern subspecies. The collections in the museums of Pittsburgh, Cambridge, and Ottawa have been examined, as well as the series in Berkeley. The summed-up impression is left that a satisfactory mean holds—of, in western birds, average greater length of wing and tail, lesser extent (width) of black or dark markings, notably on back, wing and tail, and greater extent of brown patch on top of head.

Our five Lassen-section examples in these respects fall with other western birds, and hence, it is thought, merit designation under the name *phalaena*. At the same time, the great variation shown in them is impressive, especially in regard to tones of brown, these varying on the mid-dorsum from chestnut (in no. 51736, ♀, December 28, 1927, Coyote Creek) to cinnamon-buff (in no. 53080, ♀, July 22, 1928, Red Rock P. O.). While the gross result is that the former appears much the darker, widths of the dark barrings are found to be about the same in these two extreme examples. It seems likely that the warm browns are fugitive, lightening as the wear between molts advances, and, further, that the rate of fading is greatest in the arid Great Basin end of the section.

The chief dimensions of our Lassen-section birds are as follows:

No.	Sex	Locality	Date	Wing	Tail
51736	♀	Coyote Creek	Dec. 28, 1927	203	135
48443	♂	Bloody Island	May 25, 1926	193	132
52770	♂	near Red Bluff	April 11, 1928	187	133
52771	♂	near Red Bluff	April 11, 1928	184	126
53080	♀	Red Rock P. O.	July 22, 1928	197	125

Dendragapus obscurus sierrae Chapman

Sierra Dusky Grouse

A resident in the central portion of the section, from Battle Creek Meadows to the vicinity of Fredonyer Peak. Specimens represent the following localities: Mineral, 4900 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Eagle Lake Resort, 5200 feet; Gallatin's, 5200 feet; Shumway, 5000 feet. Observed also at following places: Battle Creek Meadows, 4800 feet; Summit Creek, 5200 feet; Broke-off Mountain at 9000 feet; Spalding's, 5200 feet.

Two adult males weighed three pounds each; another weighed 1202 grams. Two adult females collected in July weighed 806.5 and 849 grams, respectively. An immature female collected September 26, 1923, weighed 650 grams. A bird in natal down captured on June 17, 1925, near Mineral weighed 13.8 grams.

Single birds were seen or heard: sometimes on the ground or on rock ledges; at times in clumps of green manzanita; most often perched in trees. They used lodgepole pine, red fir, and mountain hemlock; the upward limit of the latter seemed to coincide with the usual upward limit of the range of the bird. Some, at least, of the individuals that were observed perched in trees were on top of, and parallel with, the main limbs of the trees.

The crop of a female trapped on July 6, 1924, in a rolled-oat baited steel trap contained a quantity of unripe manzanita berries. On September 16, 1923, at 8200 feet on Warner Creek, a bird was discovered as it was eating manzanita berries. At the same station a grouse was watched as it stalked grasshoppers. The bird would stretch out its neck and slowly approach the insect until within one-half meter when it would make a quick rush forward and capture the hopper in its bill.

Hooting of the males usually lasted until later in the morning on cloudy days than on clear ones; but one individual was heard regularly each day from ten to three.

Broods of young grouse were found earliest in the vicinity of Mineral, on June 17, 1925. From that date on, broods of young with parents were encountered often. The female, as a rule, showed much concern when broods were disturbed. After making a great disturbance, fluttering on the ground and clucking nervously, until ample time was given for the chicks to hide, the parent would usually fly off to a relatively safe perch in a tree. In nearly every instance, when a family consisting of female and chicks was discovered and disturbed, a male would commence hooting in some tree in the neighborhood. Grouse were hooting in the vicinity of Mineral as late as July 31 (1925).

Mr. Ted Wells told us that grouse were most plentiful, of any place in the region, in the hemlocks on Broke-off Mountain. Bands could be found there all winter. The fire warden on Broke-off told us that in July, 1925, grouse came close about the lookout house on the very summit. The small total population in the section and the relative inaccessibility, as yet, of their homes tend to discourage hunting of this species here.

Townsend (1887, p. 200) says that he captured "young birds just hatched" at the eastern base of Lassen Peak "late in June."

Centrocercus urophasianus (Bonaparte)

Sage Hen

Present in extreme eastern portion of the section, west at least as far as Eagle Lake (see fig. 82). Specimens were preserved from five miles north of Fredonyer Peak, 5700 feet. Flocks observed by us at: Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Dransfield's, 5300 feet; Red Rock P. O., 5300 feet; Box Springs, 5300 feet.

Two females collected five miles north of Fredonyer Peak in October weighed 1078 and 1167 grams, respectively.

Wherever sage hens were found in the section they frequented the more open ground where sage-brush grew scatteringly and less than one-half meter in height. All the birds that were seen were in places such that their range might include some spring or permanent stream. The observed presence of many birds, as well as tracks, at these sources of water supply indicated that the flocks went there often, probably daily, to drink water (Dixon, MS).

Even though these birds are so large, their coloration is such that it proved to be difficult to see individuals, whose exact location was known, when they crouched on the ground amid sparse cover even if only a few meters distant from the observer (fig. 129). One bird that was flushed flew fifty meters and lit in a pile of flat rocks where it stretched its neck out along the ground. The bird remained in that position while a man on horseback passed it within ten meters. Another individual squatted among green weeds while it was passed by. The birds in one group of three permitted an approach to within twelve meters, when they walked quietly away. Such a mode of escape appeared to be the regular one when birds were approached in the open. Their manner of moving at such times seemed to be specially adapted to rendering the retreat inconspicuous.

Fig. 129. A wing-tipped female sage hen (*Centrocercus urophasianus*) hiding on ground where covered with sparse sage-brush. Colors and color pattern of the birds showing in such a position are close to those of the usual surroundings. Photograph taken October 6, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4487.

Fig. 130. Sage hens (*Centrocercus urophasianus*) in flight over a typical habitat occupied by this bird in the eastern part of the section. Note the conspicuousness, from the camera's point of view, of the ventral black. Photograph taken July 9, 1925, at Box Springs. Mus. Vert. Zool. no. 4636.

In taking flight sage hens at first beat their wings rapidly; but after the first burst of speed when a height of three or four meters was attained they would sail with set wings for from one-half to three-fourths of a mile (fig. 130). It was the usual thing for birds that were flying to sail and beat their wings alternately. Often a low, chucking sound was made during the flight. When flying together the birds did not go as a flock, but each flapped and sailed independently and whenever there was need. One peculiarity of flight that was noted was that each time a bird sailed it would immediately go higher into the air. After an interval of sailing a bird nearly always started flapping before the body began to fall (Linsdale, MS). Usually, after alighting, sometimes just before, each flock would move from 50 to 75 meters to one side so that subsequently the birds were rarely flushed from the place where they were seen to go down.

Fig. 131. Tracks made by sage hen (*Centrocercus urophasianus*) walking in dust. Each track measured nine centimeters in total width. Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4486.

On a hot day one flock was observed to be spending the mid-day hours near a spring, each bird lying on the ground beneath a clump of low bushes such as there dotted the open flat.

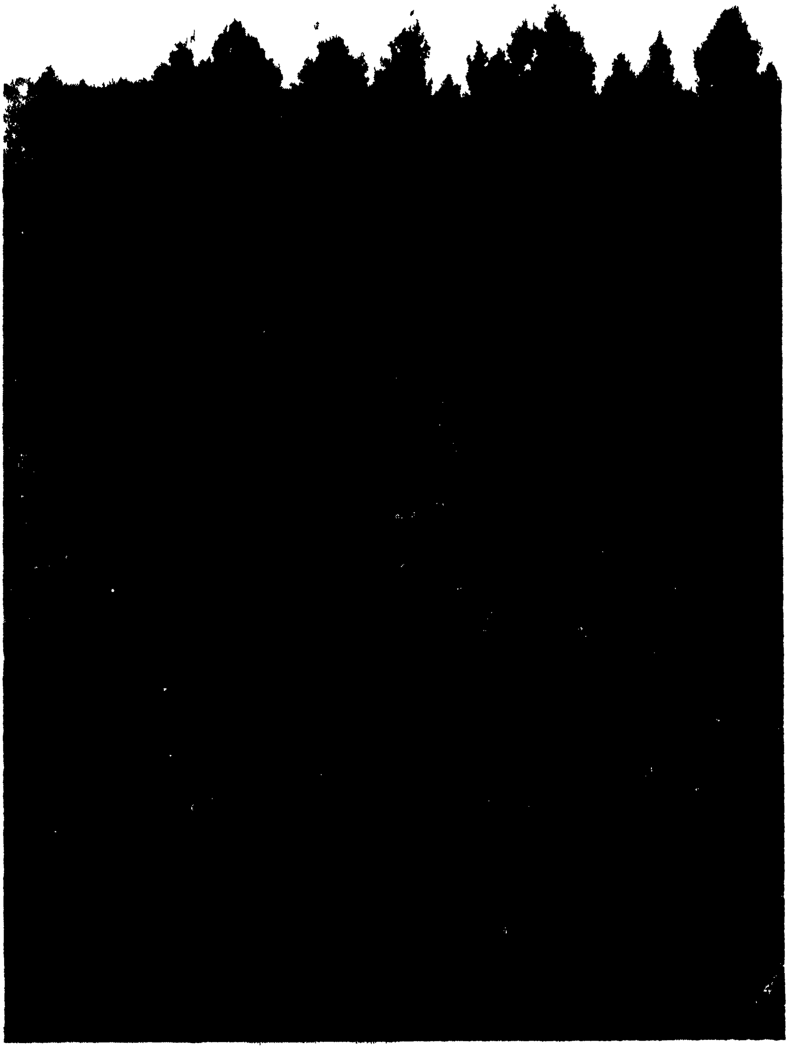


Fig. 132. A typical one-night roosting ground of a flock of sage hens (*Centrocercus urophasianus*). The group selects a rocky slope where the clumps of sage-brush are small and do not obstruct their view of surrounding ground. Accumulations of the droppings indicate the scattered arrangement of the roosting birds. Photograph taken October 6, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4485.

Tracks of birds that were walking normally were arranged in a straight line and measured 12.5 centimeters apart. Width of the individual foot prints averaged 9 centimeters. No trace of an imprint of the first or hind toe could be detected in the tracks (see fig. 131).

Flocks of sage hens were sometimes seen out in well traveled roads where they came, apparently, to wallow in the dust.

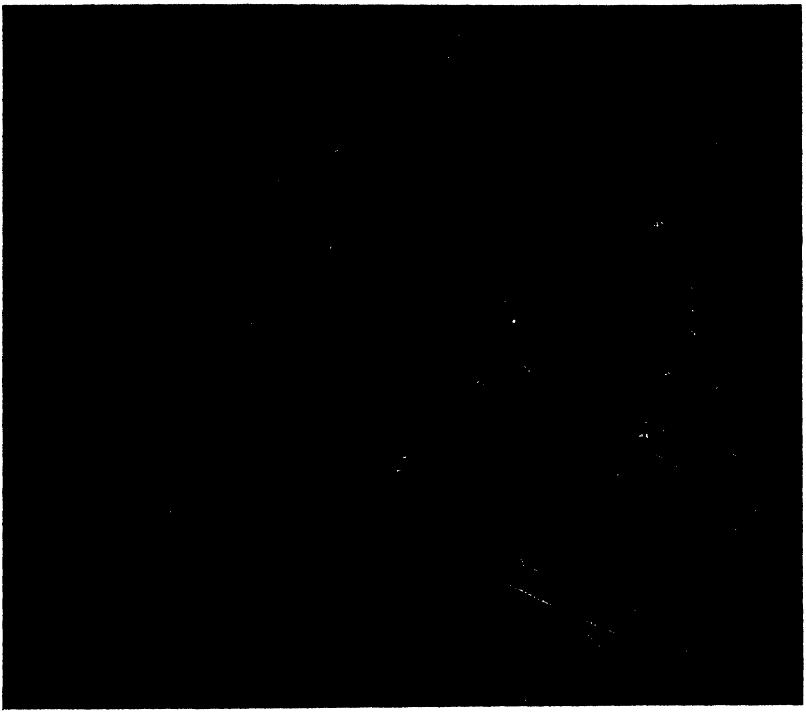


Fig. 133. Roosting place of one sage hen (*Centrocercus urophasianus*). Shows uniform size and shape of the firm droppings. Also, at right, is a deposit of the peculiar, blackish material which apparently was ejected through the bird's mouth (see p. 206). Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4483.

The green leaves of sage-brush made up the entire contents of the crop and gizzard of a sage hen that was shot, October 2, 1924, five miles north of Fredonyer Peak. The contents of the full gizzard weighed 150 grams. Usually, when going to watering places, the birds *walked* through the sage-brush and foraged along the way.

Several roosting places of this species were found (see figs. 132 and 133). In every case the roost was located on bare ground where the plants were scattered and not over fifteen centimeters high. The birds apparently avoided the neighborhood of trees. Toe marks showed that the bed was prepared by scratching away loose pebbles or sticks so that a shallow depression was left. Droppings deposited at the edge of the depression indicated that all the birds of a flock faced in one direction. They usually scattered when they bedded down so that they were about one meter apart. A place was found where twenty birds had spent a night on an area six meters square. It appeared that although a given roosting ground might be used on several occasions the flocks did not always return to the same place each night.

The individual pellets comprising a nocturnal accumulation of feces (collected October 1, 1924) are remarkably uniform in mass, shape, consistency and color, characteristic for this bird among all other animals of the Great Basin. Each is cylindrical, slightly curved, and blunt-ended, thus "jelly-bean" shaped; average of ten samples, length 22.8, diameter 9.3 millimeters. In color when fresh the pellets are light yellowish brown, but weathering quickly bleaches them to dull grayish white like the sage-leaf litter beneath the bushes. Even when fresh, the fecal pellets are firm and relatively dry to the touch; when broken to pieces the texture reminds one of dry graham cracker. The closely packed fine shreds and fragments of sage leaves give off, even four years after deposition (as preserved in the Museum), an intense odor of sage-brush. Under the weather conditions on the open ground, however, the pellets would doubtless disintegrate within a year or so.

A further feature marking most of the roosting sites was, on the opposite side of each "form" from the night's accumulation of pellets, one or more "dabs" of a black deposit, 45 to 75 millimeters in diameter in measured instances, irregular in outline, looking like licorice or black molasses, and evidently thickly fluid when fresh (fig. 133). To the human taste (*teste* Grinnell) when dissolved on the tongue this substance is intensely bitter, the quintesence of "wormwood"; indeed, despite diligent washing out of the mouth, the bitterness persisted some hours. The location of the dabs, opposite that of the feces, would indicate origin from the crop or, more probably, the proventriculus of the bird, *via* the mouth. Can it be that specialization for using the sage leaves as food has led to a digestive equipment on the part of the sage-grouse for getting rid of the possibly injurious major part of the bitter and non-nutritive "principle" of the sage?

Considered together, the features of structure and behavior that have been mentioned for this species seem to indicate that the bird is regulated to live in a uniform environment where the range of conditions which it encounters is always small. The persistence of the species is consequently dependent upon maintenance of this complex of special conditions.

It was reported that, previous to 1920, in the vicinity of Dransfield's sheep herders were accustomed to gather large numbers of the eggs of sage hens each year in the early part of April. In the same territory in 1925 only one or two nests were found by these people. Whether this diminishment be of a temporary or general significance is not known to us.

On July 9, 1925, at Box Springs, a female was seen with four young of the size of domestic pigeons. The young were able to fly although it was hard to make them start. When the brood was approached closely the female kept making a low-pitched guttural sound which the observer represented as *cauck, cauck, cauck.* Other broods in which the young ranged in size from small ones to some nearly grown were seen on the same date. One flock numbering thirty-one birds, three of them large males, was seen also on that day. That group was thought to represent four or five families that had joined.

Young sage hens were found commonly during mid-July, 1928, in Petes Valley. Some young that stayed close to camp all of one afternoon kept whistling a two-syllabled note that resembled the call of young turkeys. Near Red Rock P. O., on June 19, 1928, a scattering flock of fourteen was jumped, apparently all adults.

On the floor of Petes Valley after a rain in the early morning of June 8, 1929, a young sage hen was flushed close to the edge of some standing water. Each of the bird's feet held large masses of mud, so heavy that flight was noticeably impeded.

Although several localities in the eastern end of the section were visited in mid-June, 1929, no sage hens were seen except in Petes Valley. This apparent scarcity of the birds was also noted and commented upon by several persons who lived in the region. But as to whether the reduced numbers represented a seasonal movement in the species or an actual and decided decrease in numbers, no satisfactory explanation was heard.

Lophortyx californica vallicola (Ridgway)

Interior Valley Quail

A resident in the western part of the section below the 3000-foot contour line; also sparingly in the extreme eastern margin of the section (fig. 90). Specimens preserved from: Red Bluff, 300 feet; Coyote Creek, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Dale's, 600 feet; Manton, 2300 feet; Petes Valley, 4500 feet. Observed at the following additional localities: Blue Tent Creek, 300 feet; Mill Creek, 260 feet; Payne Creek P. O., 1600 feet; Lyman's, 3300 feet; eight miles southwest of Ravendale, 5600 feet; Box Springs, 5300 feet.

This quail seemed to find conditions in the section most suitable in the rose thickets along the river and the smaller streams, and in the vicinity of thickets of scrub oak. However, it was found also at times in such situations as the following: among lupine bushes on overflow tracts bordering the river; among willows on island in the river; in cultivated and weed-filled fields; orchard; live oak; buckbrush; blue oak; dry grassy slope; rocky plain and rocky cañon sides. In these places birds were seen on the ground, in brush piles, among the top branches of low trees and on the lower limbs of larger trees.

At Dale's when there was a heavy snow, December 21, 1924, the birds concentrated to scratch and dig in the patches of nearly bare ground under dense oaks.

A group of ten birds was foraging on December 30, 1927, among rocks on a bare hillside 200 or 300 meters from any brush cover.

A valley quail called regularly each morning and evening in early July, 1925, from dead aspens near Box Springs at the extreme eastern edge of the section.

Weights of seven adult males from the section averaged 176.3 (167.7 to 190.7) grams. Four adult females averaged 183.8 (167.8 to 200.4) grams. The heaviest female was a laying bird while the others were winter-collected.

Near Manton quail were seen on June 1, 1926, feeding on cherries that were on the ground under trees in an orchard.

On May 31, 1926, near Manton an effort to attract a small bird by "squeaking" resulted in bringing a quail slowly over the rocks, but the bird left hurriedly when it came within six meters of the observer and discovered the source of the calls. Birds that flushed together as a flock on a blue-oak covered slope (December 30, 1927) later flushed as single birds. This flock was within fifty meters of the spot where a heavy charge of shot was fired, but not a movement was detected until the birds were approached closely. In other places where there was more cover, groups of birds would escape by running.

On April 18, 1928, at Manton, a flock of quail was watched going to roost in clumps of elder and other low bushes out in the center of a field. The belts of bare ground surrounding these clumps seemed to favor choice of them, thus making it possible for the birds to detect approaching enemies more easily than in places entirely surrounded with brush.

In the western part of the section in the spring of 1928, evidence that coveys of quail were breaking up into pairs for nesting was noted as early as April 11. During the next two weeks pairs were seen frequently. In the case of one pair that was observed walking over the ground the male was leading most of the time, alternately walking and stopping to feed and preen.

On May 25, 1924, near Dale's, a quail's nest was discovered well hidden at the base of a small clump of buck-brush. Shells of twelve eggs in the nest showed well the method of hatching: The chick lies with its head at the larger end of the egg and repeatedly turning its head one way and then the other cuts a nearly complete circle through the egg membrane and the shell. The latter breaks at the isthmus left, and the chick gets out. The eggshell is left in the nest with the shallower, big-end portion or cap closed back within the other portion, hinged at one side by the remaining uncut segment of egg membrane. It seems strange that the shells otherwise should be left so perfect. Apparently neither the young in leaving, nor the adults, remove any of the shells from the nest depression, or do anything to break them up. Adults in the vicinity seemed much concerned at the presence of the intruder so that it was thought that the nest had but recently been vacated (J. Grinnell, MS).

On June 4, 1926, a female was shot near Manton, whose oviduct contained an egg that was fully formed and ready for laying. This bird was in company of a male walking over the ground in an orchard. Many broods of small young were seen at different localities between May 18 and the latter part of June.

On June 9, 1929, in Petes Valley a female with fully a dozen young was come upon. It was thought that the young had been hatched that day. They were so little and feeble that four of them were easily picked up. The brood was in a tract of sage-brush and rabbit-brush bordering a cleared place in the valley.

On the evening of July 11, 1928, on the floor of Petes Valley an adult female was found brooding thirteen downy young quail in a scratched-out depression at the base of a sage-bush. The parent, with wings slightly spread, seemed tense and ready to leave quickly, as she soon did. Taking leave so quickly threw some of the young out of the depression. The adult, out of sight among the sage bushes, immediately began calling. The young remained quiet for a few seconds; then began to leave. The mother changed the type of call and most of the young went toward her. One that was picked up had its down filled with fine brown dust. The nearest water, a small pool, was more than one-fourth of a mile away. It is likely that when the nest was started there was water available within a short distance, but by the time these young hatched, practically all the water in the valley had dried up.

A group of half-grown young was flushed, July 12, 1928, in a weed patch in Petes Valley. They flew away together.

Within the section this species was most common at the lower and western stations. There more individuals were seen on some days in summer than of most species of the smaller birds. However, the coveys seen in winter were not large, numbering usually fewer than twenty individuals. People who lived near the eastern border of the section told us that this bird was never abundant there, and that the numbers were further reduced during the exceptionally dry years of 1923 and 1924. "Planting" of quail in that Great Basin territory has been reported, and whether the present population there is really of native origin may therefore be doubted. At any rate, it is clear that the valley quail does not find optimum conditions for its existence there.

Oreortyx picta picta (Douglas)

Interior Mountain Quail

Ranges in summer in the mountains between Mineral on the west and Eagle Lake on the east. Specimens collected at the following stations: Mineral, 4900 feet; Summit Creek, 5200 feet; Warner Creek at 6600 feet. Observed at the following additional localities: Inskip Hill at 3000 feet, December 26, 1927; Turner's, 3500 feet; Lassen Highway at 3500 feet, December 29, 1924; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet.

This quail in summer frequented the chaparral-covered slopes and ridges in the belt between the altitudes of 4000 and 7000 feet. In addition to thickets of snow-brush and green manzanita, alder and willow thickets sometimes were included within ranges of individuals. Once, birds were heard calling from slopes covered with mountain mahogany. The members of a scattered flock that was flushed on top of Inskip Hill on December 26, 1927, took refuge in a dense growth of small golden oaks.

No knowledge has come to us of mountain quail occurring in midwinter higher than about 3500 feet on the western slope of our section. In other words, it appears that the entire population that summers on the mountains above the 4000-foot level moves westward in the autumn, to winter in just about the same belt as do the black-tailed deer. In evidence of this, Mr. Ted Wells, who has spent many winters on Battle Creek Meadows, states that in the fall nearly all the quail before the end of October have left this vicinity, moving westward. They come back before the snow is gone, as early as February in some years. Early arrivals in the spring will turn back if bad weather comes on. It is not to be implied here that all the birds that summer due east of Battle Creek Meadows pass west through this valley; probably those from Morgan Springs and eastwardly pass southwestward along the Mill Creek and Feather River valleys.

A quail was watched near Mineral as it gave several calls, first at the edge of a clump of bushes and later from the top of a fallen log. While the call was being made the bill was opened widely and it was held open for some time afterward. The head was held well back. The tail was not jerked when the call was made (Dixon, MS).

On June 7, 1926, a nest of this species was found on the chaparral-covered slope one mile south of Manzanita Lake. The lining of the oval-shaped nest was composed almost entirely of pine needles with a few feathers. The rim of the nest projected a little above the surrounding ground. There was no arch, screen, or other protection directly over the structure, but it was placed at the side of a boulder which projected thirty centimeters above the ground. The brooding bird did not leave the nest until it was approached to within less than one meter. There were twenty eggs in the nest so that it seems likely that more than one female laid eggs there (Linsdale, MS).

In the chaparral belt just above Manzanita Lake a female was flushed, June 26, 1929, from a clump of bushes. The bird flew hurriedly a short distance where it called anxiously for several minutes. Soon it was joined by a male. No nest could be seen nor could the presence of any young be detected. On June 27, a nest was seen beneath a bush close to the lake. The nest was made of pine needles and was partly roofed over. Contents were the shells of several hatched eggs and one whole unhatched egg.

Townsend (1887, p. 199) records finding "a nest of ten eggs east of Mount Lassen on June 12," 1884.

Newberry (1857, p. 93) records that on August 1, 1855, "at the base of Lassen's butte [vicinity of Noble's Pass], I [he] found a solitary hen, with a brood of very young chicks."

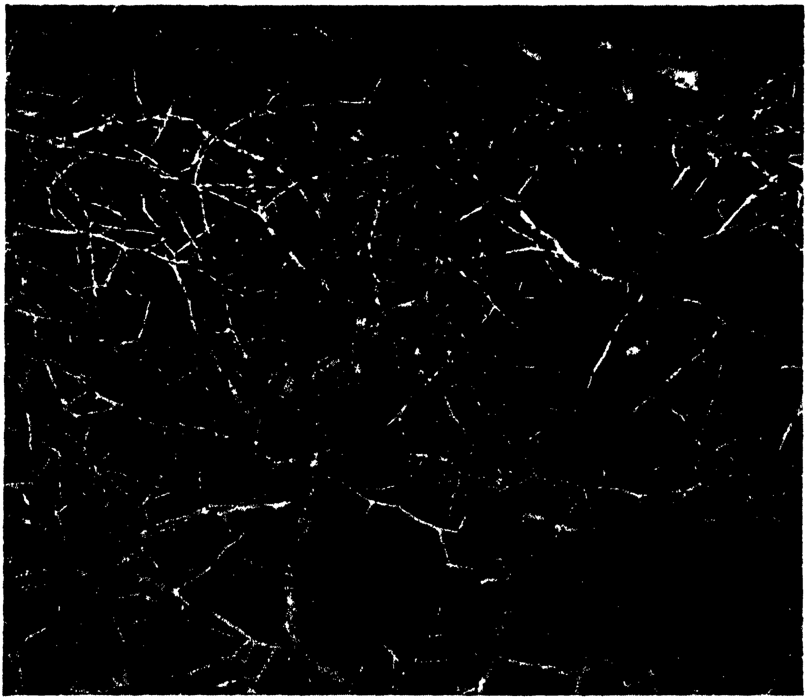


Fig. 134. Eggs, *in situ*, of the interior mountain quail (*Oreortyx picta picta*). The nest, a depression in accumulated dead leaves, was on top of a rotting log and overspread with dead and leafless stems of snow-brush. Photograph taken June 21, 1925, at Mineral. Mus. Vert. Zool. no. 4633.

A nest found close to Mineral was on the flattened top of a prostrate rotting log forty-eight centimeters thick and overspread from one side with stems of snow-brush (fig. 134). The nest was merely a depression in the mixture of débris on top of the log. It measured 150 millimeters across by thirty-five deep. About a dozen feathers were in the lining, which otherwise consisted of old snow-brush leaves, cone scales, and bits of rotten wood. The flattened, thorny branches of snow-brush over the nest furnished protection and concealment. A heavy clump of young white firs, eight meters away, shaded the site during most of each afternoon.

When this nest was discovered, on June 18, 1925, it contained two eggs. An egg was added, probably, each day, until one of the pair began brooding on June 26. On some days the egg was laid in the morning (between 8 and 9 a.m. on June 19) while on most others the time of laying was in the afternoon (between 3 and 3:30 p.m. on June 20 and several later days). When the set of nine eggs was collected, on June 28, the brooding bird remained on the nest until a branch just above the nest was lifted. The bird then sprang off to the ground and left without making a sound other than that caused by the flit of the wings. The weights, in grams, of the eggs were as follows: 11.4, 11.6, 12.0, 12.1, 12.2, 12.2, 12.3, 12.5, 13.2, average, 12.2. Indication of incubation could be detected by gross examination in only two of the eggs (Grinnell, MS).

A very young quail (weight 11.4 grams) that was trapped at Summit Creek on June 19, 1924, had two large red and black ants in its crop. The crop of an adult male that was with the young one was full of tent caterpillars and black ants (Hunt, MS).

On one occasion a parent quail that was surprised with a brood of young dragged itself along, with wings in the dust, within three meters of the intruding observer. Presently it mounted a rock and kept uttering a "jingly, scrapy *krēē-ŏh*" holding its plume erect and bowing its head with each utterance (Hunt, MS).

On June 28, 1924, a parent with a large brood was seen two miles west of Black Butte. Young that made up a covey noted at Kelly's on September 2, 1925, were in ragged transition from the juvenal to the first winter plumage. An immature male collected near Warner Creek at 6600 feet on September 26, 1923, weighed 175.5 grams.

Grus canadensis tabida (Peters)

Sandhill Crane

Cranes were observed by us at the following localities: Cone's, 270 feet, twelve in flight on December 29, 1927; Grasshopper Valley, September 23 and 28, 1924; five miles north of Fredonyer Peak, 5700 feet, October 5, 1924.

Persons who live near Red Bluff say that cranes feed every winter on, and around the edges of, the open plains north and east of there. It is their opinion that the birds feed on acorns that they find under the blue oaks.

Townsend (1887, p. 197) records seeing a sandhill crane "on a mountain meadow east of Mount Lassen in June," 1884. This is fair evidence of the former breeding of the species within the eastern portion of our section.

Since no specimens of cranes were obtained from the section it has not been possible definitely to determine the subspecies of the birds we saw there. It is not improbable that not only the sandhill crane but the little brown crane, *G. c. canadensis* (Linnaeus), is represented in the region, the latter, of course, only as a migrant or winter visitant.

Rallus virginianus pacificus Dickey

Pacific Virginia Rail

Virginia rails were collected at Willow Lake, 5600 feet, July 24, 26, and 28, 1924, and five miles north of Fredonyer Peak, 5700 feet, October 1, 1924; Petes Valley, 4500 feet, July 14, 1928, and June 8, 1929. At each of these stations the birds were found in grassy tracts at the edge of water. A mousetrap that was set in a meadow mouse runway close to Willow Lake caught, on July 24, 1924, an immature rail, in nearly complete juvenal plumage, weighing 58 grams. Weights in grams of three other young of this species, but still clothed chiefly with the black natal down, from the same locality and collected on July 26 and 28, are: 43; 45; 22. These four young birds represented, as judged by their sizes, three different broods. An adult female from five miles north of Fredonyer Peak weighed 90 grams.

At Red Rock P. O., July 24, 1928, a rail was flushed at the edge of a slough in a hay field. More than ten individuals were flushed, during the morning of July 26, 1928, in a flooded hay meadow along Red Rock Creek four miles northwest of Red Rock P. O.

At Elliott's, on April 14, 1928, two Virginia rails came to within two meters of an observer standing at the edge of the pond. One of them called loudly and walked out on open ground. The other flushed from a thicket of raspberry and flew to the *Scirpus* growing in the pond. Close by was a platform of stems that appeared to be a nest under construction.

In the summer of 1905, Sheldon (1907, p. 187) found a set of eggs in Pappoose Valley, near Eagle Lake. The species was also breeding that year "in fair numbers" in the marshy borders of Eagle Lake.

Porzana carolina (Linnaeus)

Sora Rail

A single immature sora rail was captured and preserved as a specimen on July 26, 1924, at Willow Lake, 5600 feet. It weighed 62 grams; down is yet adherent to the contour feathers about the head and to the tips of the upper tail coverts.

Fulica americana americana Gmelin

North American Coot

A single coot which was swimming in Coyote Creek was shot on December 28, 1927, as it attempted to hide in a clump of *Scirpus* that was growing in the water. Another one was seen at the same place on April 17, 1929. A pair was seen, April 13, 1928, in the edge of a slough at Silva's, south of Red Bluff. These birds swam back among willows where they hid. On December 25, 1927, three coots were seen swimming across a small opening in the pond at Elliott's, 1000 feet. A dozen or more birds that were seen on May 24, 1927, and July 10, 1928, on Wilson Lake, 5100 feet, were then very noisy.

On the morning of June 24, 1929, about fifty coots were scattered over Feather Lake. The birds were heard calling often in the night and in the early morning. Most of the individuals on the lake seemed to be gathered in a bunch in the open water near the center. There the birds were feeding by diving and were occupying much time by making rushes over the water at one another. One would lower its head to the water, stretch out its neck, and start swimming rapidly toward another bird or group of birds. The speed of the pursuing bird would increase until it would be fairly running on the surface. The pursued birds would get out of the way, if necessary they would make a short flight. This performance usually resulted in the pursuer swimming off with tips of the wings elevated in the rear and the two white spots showing conspicuously below and at the sides of the tail. At the same time one or two groups of small young were seen swimming with adults in the edge of a patch of bulrushes.

The only other locality where this species was found in the section was Eagle Lake where great numbers (4,000 to 10,000) were seen in the fall on September 28, 1924, and October 12, 1923. These large flocks were congregated near Spalding's and at the north end of the lake. According to the accounts of Mr. Ernest Spalding the birds often stay there until the lake freezes over. Sometimes they stay too long and some individuals are frozen into the ice. He reported that at those times bald eagles fed almost entirely on coots.

In the summer of 1905, when the margins of Eagle Lake were extensively bordered by tules, "large numbers" of coots bred there (Sheldon, 1907, p. 187).

Oxyechus vociferus vociferus (Linnaeus)

Northern Killdeer

Found widely in the section below 6500 feet altitude in summer, and in winter below 600 feet. Specimens preserved from Coyote Creek, 250 feet; Dale's, 600 feet; Lyman's, 3300 feet. Observed at the following additional localities: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Cone's, 270 feet, December 29, 1927; Bloody Island, 350 feet; Mill Creek, 260 feet; Elliott's, 1000 feet; Manton, 2300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Wilson Lake, 5100 feet, May 14, 1927; Willow Lake, 5600 feet, October 3, 1923; Snag Lake, 6100 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet, May 14, 1925; Spalding's, 5200 feet, October 12, 1923; Pappoose Valley, 5200 feet; Petes Valley, 4500 feet; seven miles south of Ravendale, 5400 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet; Jones', 5400 feet.

Among the types of situation where killdeers were observed in the section are the following: seepage spots; sphagnum moss bog; damp grass patch; meadow; small islands and gravel bars; edges of river, irrigation ditch, lake, and rain-pool (fig. 8); irrigated grain field; vegetable garden; dry pasture; dirt road among pines. A survey of the conditions which prevail in each of these types suggests that it is not moisture which attracts the birds, for they were found often in dry places. Further review of these habitat types shows that they possess at least one feature in common: they are all free from cover of vegetation or other similar obstruction close to the ground. In each of these places a killdeer could run freely, could see approaching enemies, and could take off into flight easily. The structure and behavior of this bird dictate that it live where it can do these things. It seems that this openness is the most important feature in holding killdeers to their preferred habitat. The seeming preference shown by this species for moist places might be a result of the usual greater abundance of food there.

A female collected in winter weighed 87.3 grams. Two summer-collected males weighed 81 and 84.9 grams.

In summer it was rarely that more than six individuals of this species were seen in one day. In winter, as on December 29, 1927, flocks of as many as twenty-five birds were found. None of the birds in the flock seen on that day would fly until the observer approached closely.

A lone killdeer was watched for twenty minutes, April 6, 1928, as it silently—not one note was heard—fed at the edge of the water in a small rain-pool on a prairie near Red Bluff. The bird moved nearly all the way around the pool, most of the time keeping out of the water. Once, it waded across where, in a few places, the water came up to its flanks.

The most demonstrative of a noisy pair of killdeers at Coyote Creek was shot on May 6, 1924. This bird proved to be a male.

On April 17, 1928, at two miles north of Dale's, four eggs of the killdeer were found. They were in a slight depression in the ground and fifty meters from the edge of a small temporary lake (fig. 8). The markings on the eggs matched in color the small rocks near-by. Another nest was found, April 22, on the same side of the same lake and, also, fifty meters from the water. The ground around the site was covered with small dark-colored rocks. The nest depression was lined with small pebbles which appeared to have been brought there by the birds, although not necessarily from more than a short distance. On April 25 there were still just two eggs, but one of them had been turned, indicating that they were being incubated.

Near Eagle Lake Resort a nest was found, June 16, 1928, on the top of one of many low, peaty hummocks in a belt about midway up the beach of Eagle Lake. The site was thirty-five meters from the edge of the water and it was entirely unshaded. The nest depression was lined thickly with bits of dry pieces of bark and weed stems. The three eggs in the nest were far advanced in incubation. One of the birds displayed itself boldly close by. Later in the day, near Spalding's, four eggs were found in another nest in the peaty belt on the beach of the lake.

At a ranch seven miles south of Ravendale there was a meadow from which small rocks on the ground surface had been picked up and placed in a low, flat pile in the center of the area. On this dry mound fifty meters across several killdeers were running about, on June 17, 1929, and calling excitedly. Near one edge of the rocks an old nest was seen which contained one unhatched egg. Apparently the young had only recently left that nest.

An abandoned killdeer's nest was found, July 15, 1928, on the floor of Petes Valley. The small depression in a meadow of short vegetation was lined with a few grass stems. The four eggs contained embryos that were nearly fully developed.

A young killdeer that was several days old was seen, April 23, 1928, at the side of a road four miles north of Red Bluff. At first, when the young bird was alone, it ran about freely and close by. Soon, one of the parents arrived and gave a warning; immediately, the young bird hid and could not be relocated. Later, another one was seen on a gravel bed, but it, too, was warned and could not then be located.

Several young that were able to fly and others that were not yet feathered were seen on May 26, 1926, near Bloody Island. Young with outgrowing feathering were found at Manton on June 2. Young that were nearly grown were found at Dale's as early as June 11, 1925. A half-grown young bird was caught in a mousetrap at Lyman's on June 14, 1924. On June 18, 1921, four young one-fourth grown were foraging with their parents on a mud bar in a creek near Morgan Spring. Here at this time willows had just reached full leaf. When pursued the little birds ran into the shallow water; but they later ran onto the gravel bars where they were successful in escaping detection by squatting and remaining motionless.

Capella delicata (Ord)

Wilson Snipe

Collected at the following stations: Dale's, 600 feet, December 21 to 28, 1924; Willow Lake, 5600 feet, July 26 and 27, 1924; Dransfield's, 5300 feet, January 3, 1926. Also observed in these localities: Cone's, 270 feet, December 29, 1927; ten miles east of Red Bluff, 600 feet, April 14, 1928; two miles north of Dale's, 700 feet, April 22, 1928; Elliott's, 1000 feet, December 25, 1927; Butte Lake, 6100 feet, June 14, 1926; five miles north of Fredonyer Peak, 5700 feet, October 5, 1924; Petes Valley, 4500 feet; Jones', 5400 feet, July 22 to 26, 1928.

In 1905, Sheldon (1907, p. 187) saw this species at Pappoose Valley, near Eagle Lake, July 1.

Usually only one or two individuals would be seen in any one day, and these were most often found on wet ground bordering a lake or a stream. Near Jones' on July 24, 1928, two were flushed among sage bushes at least ten meters from water running in a ditch. Ten or more full-sized individuals were flushed, July 26, 1928, singly or in pairs, in the flooded hay meadow along Red Rock Creek four miles northwest of Red Rock P. O. Birds that were found in winter seemed to prefer the vicinity of springs where, it seems likely, there would be a continuing food supply on account of the warmth of the water.

Three males collected in winter weighed 107, 107.8 and 108.1 grams, respectively. A female collected in winter weighed 100.7 grams and one collected in summer weighed 101.2 grams. An immature bird with much down still about the head, taken at Willow Lake, July 26, 1924, weighed 73 grams. This individual constitutes the only definite indication obtained that the species nested within the section.

This species was represented numerously in the marshy portions of Petes Valley on June 8, 1929. Many were heard making various sorts of sounds: a loud whistle made in flight; the ventriloquial "whinnying" seemingly produced by mechanical means; several kinds of harsh, chuckling notes made on the ground. Often a bird would call and make a short, swift flight, and then drop back into the grass. At other times the flights were more prolonged and wide circles were made high in the air. The behavior of the birds indicated that they were nesting somewhere in the valley.

Numenius americanus Bechstein

Long-billed Curlew

According to Townsend (1887, p. 199) this wader occurred in 1884 in the vicinity of Red Bluff in spring. Also it was known to him to be "abundant about the lakes east of the Sierras." The species doubtless then bred in the latter territory, where it is now apparently unknown in any status.

Actitis macularia (Linnaeus)

Spotted Sandpiper

A frequent summer visitant in the section below an altitude of about 7000 feet; a single winter record on the Sacramento River. Specimens from Red Bluff, 300 feet, and Spalding's, 5200 feet (also seen as late as October 12, 1923). Observed at following additional stations: Bloody Island, 350 feet; Tehama, 250 feet, December 28, 1927; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet, May 11, 1927; Manzanita Lake, 6000 feet; Mill Creek at 5800 feet, July 4, 1924; Crumbo Lake, 7210 feet, July 15, 1924; Wilson Lake, 5100 feet; Willow Lake, 5600 feet, July 19, 1924; Butte Lake, 6100 feet; Lake Caribou, 6000 feet; Feather Lake, 5500 feet; Eagle Lake, 5200 feet; Jones', 5400 feet, July 22 to 26, 1928.

Spotted sandpipers were, as a rule, in the section seen on the pebbly or sandy portions of the shores of streams or lakes. Near Mineral on May 11, 1927, when high water still covered all the natural gravel bars along the creek, a pair of sandpipers was observed on the edges of a bridge approach where there was an embankment of broken stone. Sometimes a bird would perch on an exposed log in a lake or stream, even on a fence post. Sometimes birds were seen foraging back from the water on open grass and sedge covered beaches of lakes.

A breeding female that was shot, May 11, 1924, near Red Bluff weighed 53 grams. Colors of the soft parts of that bird, as determined from comparison with Ridgway's Color Standards, were as follows: Iris, bister; bill, blackish brown on terminal five millimeters (about ⅕ of total length); basal four-fifths of lower mandible, clay color, of upper mandible, sayal brown; legs and toes, warm buff, slightly dusky at joints; claws, blackish brown (Grinnell, MS).

That spotted sandpipers begin to nest early in May in the vicinity of Red Bluff is indicated by the presence of an egg ready for laying in the oviduct of a female shot on May 11.

A spotted sandpiper's nest was found, June 16, 1928, near Eagle Lake Resort. The nest site was in a belt of grass halfway up on the beach of Eagle Lake. The depression was between grass clumps close to the side of a water-worn tree branch and was shaded by the end of another drift branch ten centimeters in diameter. The nest was lined thickly with old pine needles, dry grasses, and bits of drift wood. The rim was level with the surrounding ground. The four eggs proved to be far advanced in incubation. One of the birds was quite demonstrative, running back and forth lengthwise of a drift log near-by.

On June 11, 1929, a nest was found on the southern shore of Eagle Lake near Eagle Lake Resort. The nest was in a deeply hollowed depression beneath the upturned end of a piece of driftwood 137 meters (steps) back from the edge of the water. The lining was of grass stems. The nest rim was even with the ground surface. The brooding bird in running off the nest ran into a piece of driftwood thus attracting attention of the observer to it. A few minutes later the bird again left the nest when approached, but the start of the run was not seen. A wait of five minutes was necessary before the returning bird revealed the location of the nest containing four eggs. Early the next morning the bird stayed on the nest until approached within four meters when it flushed off the nest and ran and fluttered over the ground and drift close-by with spread wings and gave notes of alarm. On the morning after that the bird when disturbed ran less than a meter from the nest before it flew directly away.

Five or more pairs of spotted sandpipers were observed, June 23, 1929, at Lake Caribou. The birds were on rocks at the edge of the water and on the belt, thirty meters wide, of scantily grassed beach.

One nest was seen fifteen meters up the flat grassy beach and on open ground. The nest rim was even with the top of the ground. Its walls were thickly lined with needles of lodgepole pine. Three eggs were contained in the nest. The brooding bird ran off when approached within two meters and moved over the ground with widely spread wings and tail and with continual screeching.

Another nest on the opposite side of this lake was situated at the side of a rock on the shore and twenty meters from the edge of the water. Its rim projected slightly above the ground level. The materials were chiefly pine needles but also some other sticks and trash. The bird, brooding four eggs, behaved much as did the other one at this lake when frightened from the nest. As soon as the observer withdrew to the screen of the near-by lodgepole pine woods the bird ran back to and settled on the eggs.

At another place on the edge of this lake were seen four downy young, two or three days old. They were running over the beach in tow of two adults. One young one, when pursued, ran to the edge of the water and swam strongly out into the lake, returning after making a circle with a radius of three meters.

At Snag Lake, on June 25, 1929, a nest containing four eggs was seen in a depression on the ground in the center of a small shrub fifteen centimeters high by thirty centimeters in diameter. The lining was of pine needles. This site was in the center of a large bar of sand which had only recently been exposed by the lowering of the lake surface.

Another nest with four eggs, found June 29, 1928, at Butte Lake, was fifty meters from the lake shore and fully fifteen meters above the level of the lake. It was on a dry, yellow-pine-woods floor. The depression was lined with pine needles chiefly, with some grasses. The bird sat closely, only leaving to slink off over the needle-floor when approached to within six meters. This lake lacked any beaches in 1928, of either sand or gravel, because of the construction of a small dam at its outlet.

Two downy young were seen at Snag Lake on June 29, 1928. Two downy young that were found at Battle Creek Meadows on June 26, 1924, "froze" as soon as they were approached closely by the observer. Both parents fluttered near-by and called excitedly. Three other adult sandpipers came in answer to the cries of these parents. When the intruder left the young, one of the parents went to them and hovered them (Borell, MS). Several other broods of young were seen at that time in the same vicinity.

Tringa solitaria cinnamomea (Brewster)

Western Solitary Sandpiper

A single individual was observed in company of a least sandpiper on the shore of an island in the Sacramento River near Red Bluff on May 7, 1924 (Grinnell, MS).

Catoptrophorus semipalmatus inornatus (Brewster)

Western Willet

Three willets were seen together in a small pond near Eagle Lake on May 28, 1925 (Dixon, MS).

A male, weight 278 grams, and a female, weight 302 grams, were collected, July 22, 1928, at an irrigation reservoir near Jones', 5400 feet. These and at least four others at the reservoir were singly or in two's, flying, or wading in the shallow water, or walking on the mud. Also noted July 24 and 25.

In the upper part of the flat floor of Petes Valley, in June, 1929, extensive boggy places existed, with tracts of rabbit-brush intervening. There were marsh grasses and a few rushes, but very little open water. At least six pairs of western willets were observed at this place on June 8. The birds were bewilderingly demonstrative, flying from afar to meet the intruder, and just as concerned one place as another. A pair was watched on the ground, one bird of which preened elaborately, as if not long off a nest. This one, whenever another bird went by, gave a melodious "pillow-will-willet," repeated several times in continuous series. This "song" was heard also from a flying bird. Otherwise, the notes were a single "kouw," somewhat crow-like, at intervals; also a "kuk," or "kwĭk," repeated. Sometimes the birds would come for two hundred meters or more, flying directly towards the intruder; then when within three or four meters they would veer off upwards. A few times an individual flew around the observer in small circles and screamed loudly with bill open widely. While being watched the birds spent a much greater part of their time in the air than did the killdeers which were also loudly protesting at the invasion of their ground. In early morning the birds were much more active and showed more concern over intrusions than they did in early afternoon. Occasionally a bird would alight in the top of a tall clump of rabbit-brush. Most often they perched on the drier ground close to marshy areas. One bird was seen perched on a large rock close to the marshy ground.

As reported by Van Denburgh (1919, pp. 39–40), Grasshopper Valley in 1918 was partly flooded, there being an open shallow lake bordered widely with mud flats and outside these, with extensive meadows of sedges and grasses. In June of that year, there were "six or eight or perhaps ten pairs" of willets there in one place and "four or five more pairs in another part of the meadow several miles away." Five nests were found, but only one with a complete set of four eggs. June 6. Some eggs were found broken, as if "eaten by some mammal or bird." "The nests were made of pieces of weeds rather carelessly built up on the mud. Some were found where the water was a few inches deep and some where the mud was drying." One was on a clump of "red-weed."

Totanus melanoleucus (Gmelin)

Greater Yellow-legs

Two greater yellow-legs were seen, April 22, 1928, at the edge of the small prairie lake two miles north of Dale's. The one individual collected was a female, weight 172.1 grams. The remaining bird took to flight in straight-away northward course, unhesitating as far in the distance as it could still be seen.

Townsend (1887, p. 198) obtained this species at Red Bluff, April 22, 1884.

Pisobia bairdii (Coues)

Baird Sandpiper

Three were collected, April 14, 1928, at the edge of the small prairie lake two miles north of Dale's (fig. 8). The three were in a group along with two least sandpipers. One, a female, weighed 36.5 grams. Weights of the two males were 38.5 and 42.4 grams.

Pisobia minutilla (Vieillot)

Least Sandpiper

A transient in spring and fall in the extreme western and extreme eastern portions of the section. On April 23, 1928, at two miles north of Red Bluff a flock of six least sandpipers flew down a creek and lit at the edge of a small pool near the highway. Persons near by frightened the birds and they left. A female was shot, of two birds that were seen on May 7, 1924, on the pebbly shore of an island in the Sacramento River near Red Bluff; weight, 21.3 grams.

One of two least sandpipers, a male weighing 18 grams, in a group of five shore birds, was shot, April 14, 1928, at the edge of a temporary lake two miles north of Dale's. Two or three small flocks and several single birds were seen, April 22, among the rocks and short vegetation bordering this lake. Another small flock was seen there on April 25.

This species was present in small numbers on July 22, 24, and 25, 1928, on the mud around the reservoir at Jones'; a male was collected, weight 19.1 grams. Near that place, on July 26, one was seen at the edge of the water in an irrigation ditch.

Sheldon (1907, p. 187) saw this sandpiper at Eagle Lake, July 11, 1905.

Limnodromus griseus scolopaceus (Say)

Long-billed Dowitcher

Two dowitchers were collected, April 25, 1928, at the prairie lake two miles north of Dale's. One, a male, weighed 132.8 grams; the other, a female, weighed 122.8 grams.

Pelidna alpina sakhalina (Vieillot)

Red-backed Dunlin

On April 25, 1928, a male dunlin, weight 44.8 grams, was collected at the small prairie lake two miles north of Dale's. Two others, a male and a female, were collected at the same place on April 30. Several other sandpipers of this species were at the lake on this last date. They were alone or in small groups flying low over the water or close by over the prairie and giving single notes or calls. The birds seemed to take to the air on slight provocation, but they stayed always within the close proximity of the water. The stomach of one that was killed was empty except for some coarse sand grains.

Ereunetes mauri Cabanis

Western Sandpiper

A male was collected, April 30, 1928, at the edge of the prairie lake, 700 feet altitude, two miles north of Dale's. On July 24, 1928, two were shot from a flock of ten at the edge of an irrigation reservoir near Jones', 5400 feet altitude. One of these was a male, weight 22.7 grams; the other, a female, weight 23.4 grams.

Townsend (1887, p. 198) obtained specimens at Red Bluff, May 8, 1884.

Recurvirostra americana Gmelin

American Avocet

One of two avocets that were come upon, July 22, 1928, standing together on the sand at the edge of an irrigation reservoir at Jones', 5400 feet altitude, was shot. This bird was a female weighing 250.5 grams. Two more were seen at the same place on July 24, and on July 25 six or more were there, wading in the shallow water and swimming where the water was deep.

Townsend (1887, p. 198) obtained a pair of avocets "in the vicinity of certain shallow lakes in western Lassen County," June 17, 1884.

Steganopus tricolor Vieillot

Wilson Phalarope

A pair of Wilson phalaropes was shot on June 3, 1924, at the edge of a rain-pool two miles north of Dale's. A few minutes later in the same afternoon another pair lit in the shallow water of the same pool and began feeding. A single individual was seen on Eagle Lake, near Spalding's, 5200 feet, on May 27, 1925.

Both the birds that were collected near Dale's were extremely fat. The male weighed 42.4 grams and the female 56.8 grams.

An immature female, weight 46.3 grams, was shot, July 22, 1928, in a wet hay meadow near Red Rock P. O. An adult female shot, July 24, at Jones', weighed 48.5 grams. In that vicinity this species was observed in small groups and singly, walking over the moist hay meadows or swimming in pools. Some flocks were swimming in the irrigation reservoir at Jones' and others foraged on the surrounding mud flats.

Three phalaropes were seen swimming in marshy portions of Feather Lake on June 20, 1929. A single individual was seen in flight over the lake on June 24.

Townsend (1887, p. 198) obtained three specimens June 17, 1884, "in the vicinity of certain shallow lakes in western Lassen County." In 1905, Sheldon (1907, p. 187) found this species in Pappoose Valley, near Eagle Lake. Two old birds and "one chick in down" were taken there, July 1.

Lobipes lobatus (Linnaeus)

Northern Phalarope

On May 7, 1927, a broken-winged northern phalarope was found swimming in a roadside pool under a telephone line of three wires near Mineral, 4900 feet. Another in the same condition was found at the same place on May 10. Two days later a third bird was found beneath telephone wires; this one, however, was dead. Doubtless all three of these birds had been intercepted by the wires, from flocks of phalaropes migrating through the valley.

Larus californicus Lawrence

California Gull

Recorded once, January 1, 1928, flying over the Sacramento River near Jelley's Ferry. Occurs at Eagle Lake in summer; two specimens taken. Also, occasional in summer on other lakes in the eastern part of the section. Several were observed, July 22, 24, and 25, 1928, at an irrigation reservoir near Jones', 5400 feet.

Slightly more numerous in fall at Eagle Lake than early in summer. Twenty individuals seen September 28, 1924, at the north end of the lake comprised the largest number found in any one day of that year. Small islands in the lake were used by the gulls as loafing places. This gull proved to be the chief enemy of the nesting cormorants and pelicans at Eagle Lake. A gull was observed on June 21, 1921, to take and eat two out of five eggs in a cormorant's nest. This was done while the cormorant was off its nest.

Four nests of the California gull were discovered, June 22, 1921, on a small island in Eagle Lake (fig. 135). The nests were hidden in depressions in a boulder pile. Incubation was well started in the eggs, which numbered two and three per set (Dixon, MS).

On the morning of June 11, 1929, nine gulls were seen high in flight over the south edge of Eagle Lake. All except one was in white adult plumage. Another similar group was seen in late afternoon.

On June 13, 1929, close to fifty gulls were present about the island in Eagle Lake on which the colony of pelicans nested. The birds mostly were resting on the sand or on rocky points or were in flight overhead. Two nests were seen, placed at the bases of clumps of a white flowered loco weed out on dark, coarse gravel. These nests contained one and two eggs, respectively. The gulls seemed to be concerned at our close approach. They exhibited no tendency during our stay in the vicinity to harm the eggs or young of the pelicans which were nesting close by.

In late June, 1884, Townsend (1887, p. 191) found California gulls "in abundance at Eagle Lake" though "comparatively few" were found to be breeding there.

Fig. 135. Nest of California gull (*Larus californicus*) composed of feathers and placed between rocks on an island in Eagle Lake. Photograph taken June 22, 1921. Mus. Vert. Zool. no. 3653.

Larus delawarensis Ord

Ring-billed Gull

Townsend (1887, p. 192) records definitely that he took a "solitary specimen of this Gull" at Summit Lake, due east of Lassen Peak, on June 5, 1884. Early in the afternoon of July 25, 1929, a lone, adult, vagrant ring-billed gull was seen at Hat Lake. This small lake was made in Hat Creek by the mud flow from the Lassen volcano in 1915 (Grinnell, MS). These birds were doubtless stragglers; the species is thought not to breed nearer than Clear Lake, Modoc County, California.

Sterna forsteri Nuttall

Forster Tern

Four Forster terns were seen at 5:30 A.M. on May 14, 1924, flying up the Sacramento River eight miles south of Red Bluff. On May 18, 1925, fourteen were seen resting on exposed rocks which stuck up as small islands near the west shore of Eagle Lake. About ten were seen near Spalding's, June 16, 1928. Two individuals were noted, May 28, 1925, in the cat-tail swamp at the head of Willow Creek. A male was collected at Eagle Lake, May 23, 1925.

On June 9, 1925, James Moffitt (MS) found nearly 100 pairs of this tern nesting on the northwestern side of Eagle Lake near Spalding's. The nests, located in a marshy tract, contained one to three eggs each.

In 1929, several individuals of this tern were observed, June 11, foraging along the southern shore of Eagle Lake. On June 13, sixteen terns were seen in one group resting on rocks along the shore of the lake near Spalding's and others were observed on low, sandy portions of islands.

Hydroprogne caspia imperator (Coues)

Coues Caspian Tern

Two birds of this species were observed, May 28, 1925, flying over an island in Eagle Lake, and four other individuals were seen, June 29, the same year, sunning themselves on a ledge of rocks which projected from the water near the shore of the lake. Attention was attracted to these birds by their coarse voices (Dixon, MS). Two or three individuals were seen, on June 11 and 12, 1929, repeatedly flying back and forth over the water near the southern shore of Eagle Lake. The birds kept at ten to fifteen meters above the water. They gave the coarse cry of the species at frequent intervals.

Chlidonias nigra surinamensis (Gmelin)

American Black Tern

Observed as transient on the Sacramento River near Red Bluff, May 9 and 13, 1924, and as a common summer resident on Eagle Lake, near Eagle Lake Resort, and near Gallatin's. A male and female, both adult, collected at Jones', July 24, 1928, weighed 63.6 and 52.1 grams, respectively. Molt was well along in the female, while scarcely a trace of white could be detected in the male.

This bird was restricted in summer to small, sheltered, shallow and tule-grown sections of Eagle Lake. On May 18, 1925, individuals were present near Eagle Lake Resort to the number of, at least, one hundred. On May 21, there, no nest-building was seen under way, but there was considerable fighting over territory. On July 1, a search for nests failed to reveal any, although more than fifty birds still remained in the vicinity.

On June 22, 1921, a colony of black terns was found nesting at Eagle Lake in a protected bay filled with isolated tule patches inside a heavy outer fringe. Scattered about, usually one nest to a clump, were fifteen or twenty nests. These nests were made of "moss" piled on floating boards or pieces of bark of yellow pine. The two eggs of one set that was saved differed in color from those in other nests in this colony and from other eggs that are available for comparison. The ground color in each of these eggs is sayal brown, that is, a decidedly reddish rather than olive color, and the spottings are brightly chocolate.

At the northwestern side of Eagle Lake near Spalding's, James Moffitt (MS) found many nests containing three eggs each, on June 9, 1925.

On June 20 and 24, 1929, at Feather Lake more than fifty black terns were observed flying about and calling over marshy portions of the lake. No hint could be gotten as to the nesting place although most of the flying seemed to be over one particular part of the marsh-covered ground. However, no nest supports could be seen there. The birds may have had nests out in the patches of bulrush. When the observer stood still several terns flew about and protested loudly.

From July 22 to 26, 1928, many black terns, more than seventy-five, were seen in the neighborhood of the reservoir at Jones' and over standing water in the valley of Red Rock Creek northwest of Jones'. The birds were perching on snags or flying back and forth between the two bodies of water. Some that were carrying objects in their bills may have had young in nests near by at that time. Some of the birds seen had a few white feathers, indicating that the fall molt had started.

Columba fasciata fasciata Say

Northern Band-tailed Pigeon

On the afternoon of April 21, 1928, a lone band-tailed pigeon was seen to fly with audibly flapping wings from the top of a tall dead pine four miles southeast of Manton. A few individuals observed at Manton, 2300 feet, May 30 and 31 and June 4, 1926, were the only other ones encountered in this neighborhood. These latter birds came in pairs or small groups to orchard trees which bore ripening cherries. They came to within fifteen meters of a tent, but they would leave hurriedly when a movement, even slight, was made near by.

Several groups of pigeons of from one to thirteen birds each were seen perched, April 18, 1929, in the tops of blue oaks on the hills six miles northeast of Red Bluff (fig. 53). Accumulations of feathers on the ground beneath the perching trees indicated that the birds had been in the vicinity for some time; probably they had stayed all winter to feed on the acorn crop. A flock was seen in flight over Inskip Hill on April 19.

Six pigeons were flushed, on June 24, 1929, from the tops of tall yellow pines close to the edge of a small lake near Butte Lake.

Zenaidura macroura marginella (Woodhouse)

Western Mourning Dove

Frequent in summer and occasional in winter in the section at stations below 6500 feet altitude. A male was collected, April 10, 1928, of a pair that perched on a wire fence at the side of a road ten miles north of Red Bluff. Observed definitely at the following places: Red Bluff, 300 feet; Coyote Creek, 250 feet; Cone's, 270 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet (May 14 and June 25); Butte Lake, 6100 feet (June 27); Bogard R. S., 5500 feet; Feather Lake, 5500 feet; Eagle Lake, 5100 feet, at several points (June 16–17); Pappoose Valley, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4700 feet; Red Rock P. O., 5300 feet. The male that was collected as above weighed 117 grams.

In winter, mourning doves were seen in the Sacramento Valley on the ground in weedy fields or on recently plowed land. A few were seen singly or in small groups in trees, usually cottonwoods or sycamores along streams. However, even in these places, the birds were much less numerous in winter than in summer.

In summer, doves were seen in a greater variety of places. They were most often observed then on the ground at the edges of water holes or along roads, or perched on fences or telephone wires. Branches of dead trees were favored as perches. In Petes Valley during the hot mid-day hours of July doves sought shade at the bases of sage-bushes. At other times they perched in cottonwoods on the valley floor or in junipers that were scattered at the edge of the valley.

On December 22, 1924, near Dale's, the full summertime cooing of a mourning dove was heard several times from creek-side trees.

Sheldon (1907, p. 187) records that "a few" bred in 1905 at the "northwest end" of Eagle Lake (probably near Spalding's).

A portion of the courtship behavior of one pair of mourning doves was watched, April 24, 1928. The birds were perched in the top of a dead tree near Cone's. One, presumably the male, at intervals, each time after a series of calls, would fly out seventy-five meters from its perch and sail in a circle, returning to the same tree.

A dove was flushed from a nest near Dale's, May 22, 1924. The structure was sixty-eight centimeters above the ground, supported upon several horizontal, stiff stems of buck-brush. Other branches of the bush furnished shade for the nest and eggs. Incubation was far advanced in each of the two eggs.

At Petes Valley nests containing two eggs were found on July 13, 1928, at the bases of weeds or bushes. On July 21, at Jones'; a nest was found in a clump of sage-brush and placed on the foundation of an old nest of some other bird. This nest was one meter above the ground. In it were two eggs.

Young doves that were nearly grown were found, July 15, 1928, in a nest in Petes Valley. The nest was at the base of a small bush on a broken-lava-covered plain, but it was unshaded. When approached closely, the adult on the nest left and fluttered away. One of the young birds fluttered away in like manner, but the other remained motionless in the nest.

At eight miles southwest of Ravendale a nest was found, July 18, 1928, which was on the ground at the base of a sage-bush. The brooding adult flew off the nest, which contained two young half-grown, and fluttered away.

On June 8, 1929, a nest was seen on dry, cracked ground in Petes Valley. The nest was made of light straws and was placed on the ground between two clumps of grass. When disturbed the brooding bird flew directly off the two eggs in the nest. On every side for 100 meters or more were grass and sedge clumps with some small herbaceous plants.

Doves kept coming and going to and from the group of cottonwoods in the center of Petes Valley when the place was visited in early June, 1929. Close to twenty birds were seen in the trees at one time. They perched, and cooed, up in the trees although they spent most of their time on the ground or in flight.

Geococcyx californianus (Lesson)

California Road-runner

On December 31, 1924, a road-runner was killed at 2500 feet altitude five miles east of Payne Creek P. O.; it was a male, weighing 430 grams. One was seen on an open prairie eight miles northeast of Red Bluff, on January 1, 1928. Another individual was observed, April 18, 1929, in this same vicinity. When the observers stopped near it the bird started to run off. It would run a few steps then stop and turn with the whole body at right angles to its general path, and watch the intruders. Then it would run another short distance and repeat its turning. Another was seen on July 25, 1925, within one mile above Dale's. People who lived in the western part of the section reported having seen this species at many places below the 3300-foot contour line. Trappers told us that whenever a road-runner is found in a setting of traps (which, we gathered, was rather frequently) it was "simply killed and thrown away."

Townsend (1887, p. 204) found the species "not uncommon at Red Bluff, where one was captured" during his residence there, 1883–84.

Tyto alba pratincola (Bonaparte)

American Barn Owl

Specimens of this resident owl were obtained at Cone's, 270 feet, and Dale's, 600 feet. In addition, this species was observed at: Red Bluff, 300 feet; Bloody Island, 350 feet; Red Rock P. O., 5300 feet (one seen July 22, 1928, by C. C. Lamb). The species is thus regularly present in the upper Sacramento Valley; at the eastern end of the section its status is problematic.

Two or more barn owls flew about and called among the tops of trees in a grove of large valley oaks near Bloody Island each evening during the latter part of May, 1926. About one mile from the grove one individual was found regularly to roost each day among the beams of a large hay barn. The sides of this barn were open so that the whole inside was light. Accumulations of pellets on the ground beneath the roosting places indicated that the roosts had been used for some time.

Sixty-seven of the pellets from the above roosting place were picked up and preserved, to be analysed subsequently at the Museum. No animal remains were found represented save for mammals; of these there were identified 126 individuals, of 8 species, as follows: *Sorex ornatus,* 1; *Thomomys bottae,* 29; *Dipodomys heermanni,* 3; *Reithrodontomys megalotis,* 34; *Peromyscus* (at least the majority, of the species *maniculatus*), 19; *Microtus californicus,* 37; *Sylvilagus auduboni* (young), 1; *Sylvilagus bachmani* (young), 2. With most of the above species the subspecies concerned may be inferred reasonably upon geographic considerations. Curiously, in two cases, bones found within normal looking pellets still showed flesh (dried) adhering to them—as if removal of the flesh had not been complete at the time of pellet ejection. Associated with the hair and bones in a pellet containing a nearly entire skull of kangaroo rat were 60 seeds and 3 empty seed cases af alfilaria, doubtless as contained in the cheek pouches of the rat at time of capture by the owl.

Otus asio quercinus Grinnell

Southern California Screech Owl

A resident in the section west and down from Battle Creek Meadows. Specimens obtained at Dale's, 600 feet. Notes of this species were heard at the following localities: Blue Tent Creek, 300 feet; Red Bluff, 300 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Battle Creek Meadows, 4800 feet.

The three screech owls obtained, all from Dale's, proved puzzling in their subspecific characters. In size, they are large, approaching *macfarlanei*; but in dorsal color they are grayer, less warmly brown, than *macfarlanei* or even *bendirei.* After much comparing, we place them under the name *quercinus,* but in doing so point out certain slight differences from the mean of *quercinus* as represented by specimens from the San Diegan subfaunal district. These differences consist in longer wing, stouter bill, paler ground-color below, and slightly grayer tone of general color on dorsum. The three skins in question give key measurements in millimeters as follows:

Number	Sex	Date	Weight (grams)	Wing	Tail	Bill from nostril
51737	♂	December 21, 1927	131.5	164.5	83.1	11.4
51682	[♂?]	December 14, 1927	143.5	160.7	79.9	11.7
51738	♀	December 23, 1927	163.2	163.4	80.6	12.9

Bubo virginianus pacificus Cassin

Pacific Great Horned Owl

A resident, widely distributed over the section eastward to Eagle Lake (fig. 97). Specimens represent the following localities: Red Bluff, 300 feet; Payne Creek P. O., 1600 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet. Horned owls were heard or seen at the following places where no specimens were obtained: eight miles northeast of Red Bluff, 500 feet; Cone's, 270 feet; Bloody Island, 350 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Warner Creek at 8000 feet; Drakesbad, 5500 feet.

An adult male from Red Bluff, May, weighed 988 grams. One from Payne Creek P. O., April, weighed 2 pounds. A male and two females from Spalding's, October, weighed 1180, 1220, and 1668 grams, respectively. A young female just out of a nest and not yet fully fledged, from Butte Lake, weighed 923 grams.

On April 18, 1929, a horned owl was flushed from a small cavern in an undercut bank of the Sacramento River (fig. 80) near Bend Ferry. This adult had been with two young owls close to one-fifth grown. It soon returned to the top of a near-by willow and snapped its bill as did one of the young when they were watched. The smaller and weaker young bird did not rouse up and it was not aggressive. A part of a young jack rabbit was lying at the nest. The platform was directly beneath a group of old nests of the cliff swallow.

Two young owls able to fly but just out of a nest were seen in a clump of oak trees close to the Sacramento River, May 9, 1924. The young birds showed little fear and allowed the observer to approach them to within six meters. Another juvenile, still partly covered with fluffy down feathers, was shot from the lower limb of a large pine just north of Butte Lake on June 19, 1926.

The hoots of this bird were heard most often at night or in the early morning. An exceptional experience was of hearing one near Red Bluff several times at 3 P.M. in the afternoon of January 1, 1928.

Bubo virginianus occidentalis Stone

Pallid Great Horned Owl

Resident in the Great Basin portion of the section, where widely distributed (fig. 97). Specimens were obtained at Shumway, 5100 feet, and near Termo, 5300 feet. Also, horned owls were heard or seen at: eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet; Dransfield's, 5300 feet (in January); Box Springs, 5300 feet.

Weights of a male and a female from near Termo, October 11 and 12, 1924, were 1160 and 1184 grams, respectively. The stomach of the male contained one red-shafted flicker and one meadow-mouse. The female had eaten a California jay and a bushy-tailed woodrat.

Two horned owls were seen at 6 o'clock on the morning of July 25, 1928, sitting in a hay-door in a barn close to Red Rock P. O. On the morning of July 22, in the same barn, at the same time, a horned owl and a barn owl were seen.

The two specimens from Shumway were collected there September 18, 1916, by Mr. C. S. Mueller, and they served as the basis for the first inclusion of this race name in the list of California birds (see Swarth, 1921, p. 136). Our two additional examples, from near Termo, are practically identical with those from Shumway. One of the specimens from Eagle Lake, and which we have listed elsewhere, under *pacificus*, departs in color tones from *pacificus* somewhat toward *occidentalis*. Indeed, all the facts indicate complete continuity of horned owl population from one end of our section to the other, accompanied, in the portion of the territory lying from Eagle Lake toward Shumway, by gradual blending of the characters of the two races.

Glaucidium gnoma californicum Sclater

California Pigmy Owl

On September 30, 1923, at 10 A.M., a pigmy owl was heard calling among yellow pines near Warner Creek, at 6600 feet altitude. Late in the previous evening and early that morning one was heard along the rimrock above the creek (Dixon, MS).

In the California Academy of Sciences is a specimen (no. 4238, J. and J. W. Mailliard) taken by J. M. Willard at or near Eagle Lake, November 23, 1899.

Speotyto cunicularia hypugaea (Bonaparte)

Northern Burrowing Owl

Specimens were obtained from near Coyote Creek, 270 feet, on May 6, 1924, and December 28, 1927; Dale's, 600 feet, January 17, 1928; Petes Valley, 4500 feet, June 9, 1929; Box Springs, October 17, 1924. One was seen, April 13, 1928, on a gate in an irrigation ditch three miles south of Red Bluff. Observed also at Red Rock P. O., 5300 feet.

Weight, in grams, of a male, May, 142; a male, December, 188; of a female, October, 128.5.

In the eastern part of the section this owl occupied burrows in tracts of sage-brush on valley floors and in the uncut borders of hayfields. Holes that were occupied by owls had at their entrances accumulations of trash that had been scratched to the outside. This trash consisted of loose dirt, and feathers, droppings, and pellets of the owls. The pellets contained chiefly the chitinous hard parts of insects, with an occasional mammal bone.

When disturbed at their homes the owls would fly up and, calling as they moved, take a perch on some elevated mound, a fence post, or a rock. There, it was usual for the bird to "bob," bending its legs, each time it called.

The stomach of a burrowing owl that was shot south of Red Bluff on May 6, 1924, contained only insect remains—beetles, grasshoppers, crickets. The bird was at the mouth of a modified, ground squirrel burrow.

In the afternoon of June 9, 1929, four occupied nesting burrows were seen on the floor of Petes Valley. One of these burrows was excavated by us. It was out on pastured ground with tall dead weed stalks scattered about, on one of which an old owl had been seen perched. Often when a person walked by, one or both old birds would fly from the entrance mound; one of the birds might stop on the ground a few meters off and utter a chuckling chatter of protest or alarm. When the burrow was approached at the beginning of the digging, one of the parents flew away silently and did not return while the digging was going on. The tunnel, possibly an old skunk burrow, proved to be about 2½ meters in total length, but decidedly unstraight, about, in plan, like a question mark—?. The height and horizontal diameter of the tunnel-way measured 140 to 144 mm. in different places. The greatest depth reached was 800 mm. to floor. The terminal cavity was 165 mm. in height and 240 wide. There were 660 mm. of earth between its roof-wall and the ground surface. Shredded, dry, horse manure paved the entrance way, the floor of the tunnel throughout, and the floor of the nest cavity. From the latter upwards there was a small hole which might have served for ventilation.

When the burrow had been dug out two-thirds of the way to the end, a buzzing screech was heard that seemed so nearly like a muffled rattle of a rattlesnake that it was hard to feel sure that there was no snake in the burrow. As the digging proceeded this noise was heard more and more clearly. Finally the terminal cavity was opened up, disclosing only the six young owls. Their main defense was the utterance of the rasping, penetrating, rattling hiss, nearly like the angry buzz of a rattlesnake when disturbed on a warm day. The bill clicks which were produced less frequently than the rattling notes were rather weak. This latter utterance was deterrent in our case;

might it not be so as regards carnivores that dig out or enter burrows such as the burrowing owls inhabit? Badgers, coyotes, weasels, and possibly such rodents as marmots and ground squirrels might thus be deterred from molesting the owls.

Besides pellets of mammal hair on the mound the only food remains in or near the nest were one June-beetle and a headless *Perognathus parvus mollipilosus.* When the young owls were placed on the ground they began to hop away in different directions. Some of them hopped back down to the opened nest cavity. Three were preserved as specimens. Later in the day the three remaining young were observed perched on the ground around the old nest site. On the following morning the owl family was out of the nest and out of sight. An old bird then was calling anxiously from some near-by bushes.

Strix occidentalis occidentalis (Xantus)

California Spotted Owl

Only one individual was actually seen during the work in the section. This bird was found on May 28, 1927, on the ridge northeast of Mineral toward Broke-off Mountain at 5600 feet altitude. It was perched on a dead, lower branch of a white fir about eight meters above the ground and remained some minutes, permitting leisurely scrutiny with 8-power binoculars at a distance of thirty meters. The bird paid little or no attention to the group of people who happened to be on their way up the trail, and who stopped to watch it. Many details of color and structure characterizing the spotted owl were noted, even to the "black" eyes. The bird finally took flight, in course directly across our path low above the ground and within, at nearest, twenty-five meters, disappearing in the thick Transition-zone woods. (Witness: Professor and Mrs. James T. Allen, J. and H. W. Grinnell, *et al.*)

At Kelly's, 5200 feet, calls were heard on the evening of September 2, 1925, that were thought to be those of the spotted owl (Swarth, MS). Notes of this owl were heard many times on the evening of July 23, 1929, in the forest north of the highway about one mile due west of Mineral (Grinnell, MS).

Asio wilsonianus (Lesson)

American Long-eared Owl

On December 31, 1924, a single bird was flushed from a small live oak on the south side of Inskip Hill at 1800 feet. It was shot and preserved as a specimen: a male weighing 267 grams.

On June 17, 1929, a nest of long-eared owls was seen in an old magpie's nest in a willow clump near Box Springs. The nest was three meters above the ground. Four young nearly grown were at the nest as well as an adult. When some persons on horseback rode up, the old bird flew off but it was back at the nest an hour later. The nest had been broken down so that its top was merely a platform.

Close to Box Springs, 5300 feet, a family of long-eared owls was discovered on July 6, 1925. The four young which were just leaving the nest (an old magpie's nest) and the two parents flew from a clump of mountain mahogany.

The three occurrences cited above indicate that this species is a resident within the section in small numbers, probably on both sides of the high mountains.

In the California Academy of Sciences is a specimen (no. 4328, coll. J. and J. W. Mailliard) taken at or near Eagle Lake, September 23, 1899.

Asio flammeus flammeus (Pontoppidan)

Northern Short-eared Owl

A female short-eared owl was collected, September 30, 1915, at Merrillville, Lassen County, by Mr. C. S. Mueller. The skin is now number 41508 in the Museum of Vertebrate Zoology. This bird had but one leg, was emaciated, and was therefore thought to have escaped some time previously from a steel trap.

Phalaenoptilus nuttallii californicus Ridgway

Dusky Poor-will

A female was shot, April 16, 1928, as it perched on some drift wood in a ravine bottom at the base of a railroad embankment just north of Red Bluff. The bird was discovered when it was first flushed close by. Near Dale's, 600 feet, single birds were heard calling on May 21 and 24, 1924. One was in the edge of a barley field in the middle of the creek bottom and the other was on a lava-strewn slope back from the creek. On June 12, 1925, one was calling during the night from the brushy and stony slopes at the southeast base of Inskip Hill at 1800 feet.

Near Drakesbad on the evening of September 5, 1923, a poor-will was calling at about 5800 feet altitude on a warm south-facing slope. Other individuals were heard, May 29 and June 2, 1925, calling in late evening or early morning from rocky hillsides near Gallatin's, 5200 feet.

In the summer of 1905, Sheldon (1907, p. 188) heard poor-wills "near Popoose Valley and at Eagle Lake."

Calls of poor-wills were heard at eight miles southwest of Ravendale on June 19, and at Secret Valley on the evening of June 15, 1929.

Two specimens were collected in Petes Valley, 4500 feet, on July 13 and 15, 1928; weights, male 40.9 grams, female 41.2. The female was seen to fly to a small flat rock in a bare space beneath a tree. From there it fluttered up to a lower limb of the tree and back to the rock. This bird's eyes reflected red when a flashlight was thrown on it. The male was shot at dusk as it perched on the gravelly bed of a dry wash. These birds were thought to constitute a mated pair since no other individuals were seen and they were shot at places only a few meters apart, even though on different dates.

Dr. C. H. Townsend (1887, p. 206) records that on July 10, 1884, "in the pine forest at the eastern base of Mount Lassen" he "started a bird of this species from her eggs." These were of "characteristic creamy whiteness" and lay "on the ground, in the open forest, entirely unprotected by nest or shelter of any kind."

We had expected the east-end poor-wills to differ from west-end birds, and to represent the race *nuttallii.* However, the specimens taken are alike; none is appreciably different from *californicus* of west-central and southern California. The characters shown by the three Lassen-section skins are: small size, reduction of white areas, weak silvering on upper surface, extension of black markings, and greater infusion of buffy in light areas—all these features in comparison with Great Basin examples assumed to be *nuttallii.* Wing lengths of the two from Petes Valley are: male, 135.7; female, 138.8; the one from Red Bluff, female, 140.2 mm.

It would appear likely, from a consideration of the above facts, together with the observed occurrences at middle points in the mountainous portion of the section, that poor-wills of the Californian fauna invade eastwardly in summer clear across the higher zones and well out onto Great Basin territory (fig. 91). It is still possible that *nuttallii* gets into the section also, from the eastward; but specimens are lacking to confirm this conjecture.

Chordeiles minor hesperis Grinnell

Pacific Virginia Nighthawk

Found in summer at most of our stations between Dale's and the eastern limit of the section (fig. 85). Specimens obtained at Dale's, 600 feet, Lyman's, 3300 feet, and Petes Valley, 4500 feet. Observed only, at following additional localities: Payne Creek P. O., 1600 feet, June 12, 1925; Manton, 2300 feet, May 31, 1926; Mineral, 4900 feet (June 14, 1925, June 16, 1927, and June 13, 1928, are seasonally our earliest dates for this locality); Manzanita Lake, 6000 feet, June 5, 1926; Summit Creek, 5200 feet, June 21, 1924; two miles west of Black Butte, 6800 feet, June 28, 1924; Lake Helen, 8200 feet, July 14, 1924; Butte Lake, 6100 feet, June 13, 1926; Feather Lake, 5500 feet, June 23, 1929; Eagle Lake, several points, as early as June 13, 1929; Secret Valley, 4500 feet, June 15, 1929; Red Rock P. O., 5300 feet, June 19 and subsequently.

An adult male collected at Dale's, May 23, 1924, weighed 81.5 grams. An adult female from Lyman's, taken June 12, 1924, weighed 64 grams. Another adult female, collected in Petes Valley, July 12, 1928, weighed 69 grams.

A male was shot at late dusk, May 23, 1924, as it flew low over an alfalfa field at Dale's. The stomach of that individual was packed with insects, chiefly large green hemiptera. The species was first seen at this place on May 18, and for the following two weeks individuals were seen or heard each evening, up to five in sight at one time. Whether this species of nighthawk actually rears young so low toward the western end of the section as Dale's and Payne Creek P. O., or whether the birds seen at those points in May reached higher levels to the eastward later in the summer, as forage conditions in the higher life-zones approached their optimum, is problematic.

Between ten and fifteen nighthawks were observed foraging close to the water of a small lake near Manzanita Lake on the evening of June 11, 1926. At the same time none was observed over Manzanita Lake itself. This species was observed feeding over the lava ridge near Butte Lake on several evenings between June 13 and 20, 1926.

At two miles west of Black Butte a female was collected on June 29, 1924, the oviduct of which contained one egg that looked ready for laying.

At Eagle Lake, June 16 to 18, 1928, nighthawks were seen, at the southwest, forested end of the lake, to fly out over the water at dusk from the woods; at the northeastern, "desert" end of the lake individuals were flushed from the ground among sage-bushes on the open, lake-facing hillsides. At each end much of the foraging was done over the water. It would appear that for this species type of vegetational cover is of minimum importance with regard to daytime roosting and, possibly, nesting.

Chordeiles acutipennis texensis Lawrence

Texas Sharp-winged Nighthawk

Found in summer only at the western end of the section and below 700 feet altitude (fig. 85). Specimens collected at Red Bluff, 300 feet (observed as early as May 2), and at Dale's, 600 feet.

A male collected May 5, 1924, at Red Bluff, weighed 56 grams. A female from the same place taken May 9, 1924, which had just laid a set of eggs, weighed 64.1 grams, and one from Dale's, May 23, 1924, with one large egg yolk in the ovary, weighed 52.1 grams.

At sundown on May 5, 1924, three Texas nighthawks, a pair, and an odd male that was later shot, were flying over a pebbly tract of ground along the Sacramento River above Red Bluff. The mated pair, of which the male always followed the female, flew close together, sometimes high, sometimes low. The lone male now and then attempted to join the pair, in flight course behind the female. Finally it lit on the pebbly ground, where, at intervals, the bird would utter a prolonged trill in low, suppressed tone. It would have been impossible to see it on the gravel except for the mannerism of raising and lowering its head rather quickly now and then. The silvery white throat patch in quick motion, then caught the observer's eye.

Four days later, May 9, eggs, presumably of the mated pair, were found just before sunrise. The female bird flushed and trailed along on the ground, dragging her tail. The eggs, twenty-five millimeters apart, rested upon a clear space of fine sand surface ten centimeters across, surrounded by gravel and pebbles up to the size of cobble stones. A yellow composite with slender-stemmed flowers grew above the site, but cast scarcely any shadow (Grinnell, MS).

A female was shot at Dale's as it flew over willows and a clover field at late dusk on May 23, 1924. The ovary contained one residual follicle and one yolk 14 millimeters in diameter. This was the only individual of this species noted at that place; a proper nesting ground for this species was afforded close by on the hot lava prairie.

The present records are the northernmost to date for the Texas nighthawk both for California and in general.

Chaetura vauxii (J. K. Townsend)

Vaux Swift

A single specimen shot at Willow Lake, 5600 feet, July 23, 1924, proved to be an adult female and weighed 16.5 grams. Observed also at: Battle Creek Meadows, 4800 feet, June 25, 1924, and July 2, 1925; Mineral, 4900 feet, June 3, 1927; Wilson Lake, 5100 feet, May 18, 1927; Butte Lake, 6100 feet, June 29, 1928. All the birds seen were in flight, above or near forest. Not more than three were seen at one time.

It appears likely that this swift breeds, though sparingly, in the Boreal portion of our section; but in what situations the nests are located we have little notion.

In 1905, Sheldon (1907, p. 188) saw four Vaux swifts in flight at the southwest end of Eagle Lake on July 3.

Aëronautes saxatilis saxatilis (Woodhouse)

Northern White-throated Swift

Single birds or small groups were observed in flight at: Manton, 2300 feet, June 1, 1926; Manzanita Lake, 6000 feet, June 8, 1926; Butte Lake, 6100 feet, June 14, 1926 (Linsdale, MS).

Archilochus alexandri (Bourcier and Mulsant)

Black-chinned Hummingbird

Recorded only at Dale's, 600 feet, where females were collected on May 22 and 26, 1924. Weights were 3.5 and 3.7 grams. Neither female had laid eggs yet that season. The birds that were shot, as well as other individuals of both sexes, were seen along the creek bottom, in or close to live oaks, some of them insect-catching in the shade.

Calypte anna (Lesson)

Anna Hummingbird

On January 1, 1928, an adult male was shot from a perch in the top of a small blue oak, eight miles northeast of Red Bluff. Two other "singing" males were seen near-by and in similar situations. In the vicinity were many bushes in abundant bloom, of manzanita of two species. The weight of the bird taken was 4.7 grams.

C. H. Townsend (MS) obtained a specimen at or near Red Bluff, May 12, 1884.

Selasphorus rufus (Gmelin)

Rufous Hummingbird

On May 8, 1924, a female was shot as it moved through the tops of blue oaks near Blue Tent Creek, 300 feet. At Cone's, April 24, 1928, a row of locust trees bordering a creek for over half a mile was in flower. Among the tops of these trees, feeding at the flowers and resting on bare twigs, were dozens of hummingbirds. Two birds that were shot here proved to be females of this species. A male was seen, April 10, 1928, flying low over the prairie ten miles north of Red Bluff. Additional sight records for this species are as follows: Turner's, 3500 feet, April 26, 1928 (male); Prospect Peak at 7500 feet, June 28, 1928 (one male); Petes Valley, 4500 feet, July 14 and 15, 1928 (males).

The weights of the three females obtained, as above, were: 3.6, 3.5, and 3.6 grams, respectively.

Stellula calliope (Gould)

Calliope Hummingbird

Found as a summer resident in the section from the vicinity of Battle Creek Meadows on the west, eastward to Eagle Lake; casual(?) in late summer east toward the Madeline Plains. Specimens obtained at: Mineral, 4900 feet; two miles west of Black Butte, 6800 feet; eight miles southwest of Ravendale, 5600 feet (July 19, 1928). Recorded, on basis of sight identification, from following additional localities: Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Lake Helen, 8200 feet; Lassen Peak at 9500 feet; Butte Lake, 6100 feet; Prospect Peak, 8340 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet.

In 1905, Sheldon (1907, p. 189) took specimens on the northwest side of Eagle Lake, July 5, and at Pappoose Valley, July 1.

The weights of the two adult females taken were 2.3 and 2.5 grams.

The seasonally earliest recorded occurrence of this species in the section is of a male observed at Mineral, May 8, 1927, and the latest is that of a female or young one that was seen August 1, 1925, as it hovered before a patch of blue lupine at timber line on Lassen Peak.

In early May in the vicinity of Mineral this species appeared to have just one plant, a species of lousewort (*Pedicularis semibarbata*), which it frequented. The flowers grew on low spikes from leaf rosettes under snow-brush. The hummers had to fly down among close-set twiggage of the bushes to get at these flowers. Often they alighted almost on the ground to get at the horizontal tubes. By May 28 they were very active in a tract of blossoming manzanita at 6000 feet, even among snow banks. A female was seen at a snow-plant (*Sarcodes*) where these plants were first coming up, on June 26, beneath red firs.

This hummer was observed to be very restless; the males kept to any one perch but a few seconds at a time.

Examples of the territorial relations in this hummingbird were observed at Mineral. On a six-acre plot of ground where the activities of individual birds were observed closely through several nesting seasons four separate males kept distinct "stands" each for itself. As nearly as could be determined all the females that were seen on this plot were visitors whose nests were off in a belt of lodgepole pines on Battle Creek Meadows. Females came onto the plot to forage about flowers (*Castilleia*) that were plentiful there, and then were shown attention by the males.

The stand of one male was on a telephone wire directly above quantities of flowers to which a female frequently came. Another male divided his time among the growing tips of three closely adjacent young yellow pines slightly overtopping a sea of snow-brush. Another perched chiefly on one of the highest twigs of a service-berry thicket in an opening among firs. One male was established on the tallest, scrub black oak tip, driving away from the vicinity any approaching forager.

An exhibition of courting flight that seemed fairly typical for this species was observed on May 16, 1924. A female was down in a blossoming currant (*Ribes cereum*) bush. A male started towering from her vicinity, slowly at first and with an audible buzz, then faster until he reached a height of fully twenty-two meters. Then he shot down in a broadly U-shaped course, passing the bush closely (barely missing it) and ascended to an equal height on the opposite tip of the "U." At the moment of passing the bush, within which the female was perched, he gave out a droll, flatted sound *bzt*—short, not loud, like a bee held down. After making three complete sky-dives, the male, on coming down the last time, perched six meters away at the tip of a stem of budding service-berry bush. The female began at once to feed at the currant flowers within the abundantly white-flowering bush.

A female observed, May 10, 1927, at Mineral, appeared to be prospecting for a nest site among the mid-height branches of a lodgepole pine.

A nest was found July 2, 1925, in a tract of good-sized, much-branched lodgepole pines on Battle Creek Meadows. The nest was first discovered by watching the female fly to it. Later the bird picked webs from dead branches fifty meters away and added them to the nest which appeared to be then nearly completed. The nest was nine meters above the ground and it rested upon a partly disintegrated cone on a twig which was given off directly beneath a larger limb, 35 millimeters in diameter. The twig was one meter out from the main trunk of the tree, at that point 25 centimeters in diameter. On July 8 the female was brooding two eggs in the nest. She left when the collector climbed to within a little over one meter of the nest (Grinnell, MS).

Megaceryle alcyon caurina (Grinnell)

Western Belted Kingfisher

A specimen was obtained, October 4, 1924, five miles north of Fredonyer Peak, 5700 feet. In addition, this species was observed at the following localities: Red Bluff, 300 feet; four miles south of Red Bluff, 270 feet; Coyote Creek, 270 feet; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Mineral, 4900 feet (December 21, 1927); Willow Lake, 5600 feet (July 19, 1924).

The bird taken, as above, was an adult female and weighed 184 grams. Its stomach contained elytra of beetles in addition to fish bones.

On the Sacramento River a few miles above Tehama, on May 14, 1924, a nesting tunnel thought to be then occupied by belted kingfishers was observed in a river-facing bank six meters high, the entrance being one meter below the brink. The characteristic double track of footmarks showed on the floor of the entrance, and a bird showing concern perched in the vicinity. Two similar tunnels close by were occupied by rough-winged swallows.

In the summer of 1905, Sheldon (1907, p. 188) reports a pair of kingfishers as inhabiting "the shore of Eagle Lake" at its southwest end.

Colaptes cafer collaris Vigors

Monterey Red-shafted Flicker

Widely distributed resident in the section up to 4900 feet altitude; also in summer occurring up at least to 7500 feet and in places clear to the eastern end of the section. Specimens collected at the following localities: Red Bluff, 300 feet; Cone's, 270 feet; Dale's, 600 feet; eleven miles east of Payne Creek P. O., 3500 feet. Also observed at the following additional localities: ten miles north of Red Bluff, 500 feet; Blue Tent Creek, 350 feet; Coyote Creek, 270 feet; Silva's, 270 feet; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; Elliott's, 1000 feet; Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Prospect Peak at 7500 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet (as late as October 26, 1923); Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet.

Weights, in grams, of five males collected in December were 130.7, 135.2, 143.4, 149.8, and 152.2. Two December-taken females weighed 144.2 and 157.9 grams. A laying female, taken May 3, weighed 151.5 grams.

Individual flickers spent much of their time foraging on the ground. For resting perches, fence posts, stumps, and trunks of trees were used. Drumming and "singing" stations were usually on high snags or dead limbs. Trees chosen for nest-hole building were ones that were dead, at least in part, and of these the ones oftenest chosen were those having the softer wood. Examples of trees frequented by flickers are: cottonwood, willow, digger pine, yellow pine, juniper, sycamore, valley oak, and blue oak.

January 1, 1928, was a rainy day in the western end of the section. Many flickers were seen that day on fence posts and in trees at the roadsides. All these individuals were quiet and sluggish in appearance, apparently because of the effect on them of the rainy weather.

At daylight on May 13, 1924, a flicker perched diagonally on a five-centimeter dead sycamore limb, alternately called (*kuk-kuk-kuk* note) and drummed a rolling tattoo. This was in the near vicinity of the Sacramento River. The same note was heard in the mountains at 6800 feet altitude as late as July 3.

In the spring of 1928, nesting activity of the flickers in the western part of the section began early in April. In the hills ten miles north of Red Bluff one bird was observed, April 10, to fly to a nest hole two meters above the ground in a dead and rotten-hearted, small oak surrounded by other blue oaks. The ground around the base of the tree was covered with freshly thrown-out chips of rotten wood. In as much as the bird flew out quietly and left the site when the observer was yet ten meters away, it was thought that probably incubation of eggs had not yet started.

On April 13, at Silva's, a flicker was seen perched at a nest hole just begun in a trunk of a dead sycamore at the side of a slough. The outline of the entrance was nearly finished, but the lower right quadrant had not yet been cut. The bird, clinging to the trunk, picked only infrequently. Most of the time it was quiet or was preening.

Near Manton on the morning of April 19, 1928, a flicker was found digging a nest hole three meters up on the east side of a dead and charred digger pine stub eight meters in height. The ground below the hole was covered with freshly thrown-out chips of wood. The opening was not regular in outline but was enlarged downward as if the rotten wood had broken out. The bird left when the observer approached to within five meters.

Another nest-building bird, a male, was watched at Cone's on April 24. This one in mid-afternoon was working at a cavity fifteen meters above the ground in a dead cottonwood. After pounding, in series of raps, for several minutes, the flicker began to carry out the chips. It would bring a billful to the entrance and fling it with a twist of the head, then look in every direction and return for another load. This was repeated eight times; then the digging was resumed and kept up for six minutes. After that another flicker arrived and entered the nest hole. Immediately one of the birds left.

A laying female was shot May 3, 1924, in a valley oak close to Red Bluff. Its nest was in a cavity in a sycamore.

In the neighborhood of Mineral the first nest building was not observed until a month later than the earliest dates in the Sacramento Valley portion of the section. In the morning of May 13, 1927, a flicker was observed close to Mineral digging its nesting hole one-third of a meter below the broken-off top of a dead and nearly de-barked yellow-pine stub fully twenty meters high. The bird seen at work here was a male. When first watched the work had progressed so that only a part of the bird's tail showed while it was digging. After each period of digging the bird would back out to a vertical outside position with tail appressed to the trunk surface beneath, and nearly every time flip over its back a billful of "chips." This vigorous backward flip of the débris resulted in its being widely scattered before reaching the ground. The bird was excavating when first found and it did not leave until after thirty-one more minutes of continuous work, with only brief pauses now and then when out, to look around.

On the morning of May 15 observations were made at this last described nest again. After some minutes the flicker arrived, alighting low down and reaching the nest-hole at the top by several spiral stages, partly flying upward, partly "hitching." The bird entered the hole, entirely out of view, at 8:54; reappeared from within at 9:05, when it rested a minute with the head partly out; then it proceeded to bring out from within load after load of chips, which showered down as if of fine, almost sawdust-like size. Forty-five such loads were counted to 9:10, delivered with striking regularity. Twelve loads delivered were counted in one sixty-second period. At 9:10 the bird disappeared again till 9:15, when its head appeared and twenty-seven loads were flipped out in three minutes; then after a long pause, till 9:19, the other flicker arrived, with scythe-whetting note, and both birds flew off. One of them returned at 9:29, flipped out several loads of chips and left at 9:31. Digging in this particular stump must have been easy and hence rapid (J. and H. W. Grinnell, MS).

On a chaparral-covered slope south of Manzanita Lake a flicker was seen, on June 7, 1926, to fly to a tall stub in which there was a nest of the mountain bluebird. The flicker clung and called outside an opening half a meter below the cavity containing the bluebird's nest. Another flicker came out of the cavity and flew away and the first bird entered. The hole was watched for ten minutes longer, but that bird did not leave. Apparently this was the procedure during incubation—for one bird to replace its mate.

At Petes Valley, July 12, 1928, flickers were carrying food to young in a hollow dead limb of a cottonwood, one of a grove in the center of the valley.

In the belt of dead water-killed timber around the margin of Eagle Lake, the red-shafted flicker was one of the chief diggers of holes. The holes thus initially provided doubtless last for generations of other hole-inhabiting but non-digging birds, such as bluebirds, swallows, and house wrens. Therefore the presence and activities of the flickers there exert control upon the abundance, if not, indeed, determining the presence, of these other birds.

On the south side of Eagle Lake a flicker was watched, June 12, 1929, which flew to the entrance of a cavity four meters up in a stub at the lake border. The bird clung there for a few seconds until another one flew out. Then the first bird entered. It would not leave when the stub was pounded. Another individual was seen to fly to and enter a hole three meters up in a stub.

Among the eight specimens of red-shafted flicker preserved we are unable to single out any one example that shows significant departure in characters toward the northwestern race, *cafer*. While there is some variation in our series as regards extent of dark markings and tones of ground color, all these are matched in a series of *collaris* from west-central California.

Ceophloeus pileatus picinus (Bangs)

Western Pileated Woodpecker

One collected, June 9, 1924, at Lyman's, 3300 feet, the westernmost station of occurrence in the section. Additional stations where occurrence was established by observation are: Turner's, 3500 feet; four miles southeast of Manton, at 3000 feet; Mineral, 4900 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; east slope Prospect Peak at 7500 feet.

The single bird taken, a nearly full-fledged young male, weighed 240.8 grams.

Individuals of this woodpecker were found in or among white firs, red firs, incense cedars, and yellow pines. Foraging birds were often working on rotting stumps or logs close to the ground. Almost invariably, even when in the tops of tall trees, the birds were on dead and softened wood.

Two pileated woodpeckers were heard pounding on May 12, 1927, near Mineral. The birds were at least one-fourth mile apart. Each tattooed a short measure of set rhythm and about ten blows, and one seemed to answer the other.

A foraging pileated woodpecker was observed on May 15. The bird alighted on a dead stub about halfway up. It picked off big black ants (*Camponotus*) here and there with gusto. As it hitched up the bare, barkless wood surface the legs were straddled far apart. The bird also hitched downward with a backward-hopping motion in which the tail functioned essentially.

Near Mineral on June 25, 1925, a family of adults and at least two young of this woodpecker were observed close around camp. The young had, as yet, shorter tails than the old birds and they flew and clung with less certainty. Also they were still being fed by the parents. A great number of low conversational notes were uttered among the members of the family, which could be heard by persons only when within a thirty-meter range.

The population in the woods around Mineral appeared to be about the same in midwinter as in summer.

That the pileated woodpecker lives in the forests of the Lassen section as far east as Eagle Lake is attested by the record of Sheldon (1907, p. 188) of a bird taken "five miles from [south of] Eagle Lake near Papoose Valley."

Balanosphyra formicivora bairdi (Ridgway)

California Acorn-storing Woodpecker

Numerous in the section west of and below about the 3500-foot contour. The most numerous woodpecker in the valley of the Sacramento. Collected at the following localities: Red Bluff, 300 feet; Coyote Creek, 270 feet; Dale's, 600 feet; Elliott's, 1000 feet; Payne Creek P. O., 1600 feet; Lyman's 3300 feet. Observed, but not collected, at the following places: Blue Tent Creek, 350 feet; four miles south of Red Bluff, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; summit of Inskip Hill, 3000 feet; Manton, 2300 feet; eleven miles east of Payne Creek P. O., 3500 feet (December 24, 1927).

A male taken in December weighed 79.4 grams. Weights of four females, December, were 73.7, 77.7, 77.9, and 83.8 grams. Three females, two in May and one in June, weighed 71.2, 81, and 67 grams, respectively.

Situations where individuals of this woodpecker were observed are as follows: top of sycamore; dead sycamore stub; in cottonwood; about clumps of fruiting mistletoe; at tips of twigs of large valley oak; in black oak; in blue oak; on dead upper limb of living blue oak; in orchard tree; on isolated digger pine; in large yellow pine; at top of dead incense cedar; on ground at roadside; on fence post; on barn end; on telephone pole.

Two environmental factors of seeming importance for the presence of this bird were an available supply of acorns and wood or bark of sorts into which the birds could bore storage holes. As to species of oak, out of the six or more present, our impression remains that no outstanding choice by the woodpeckers was shown. About as many of the birds were seen among the black oaks in the vicinity of Payne Creek P. O., as among the valley oaks around Cone's. However, tracts of black oaks recurred east of the main mountain mass in the section, as along the upper Susan River and near Eagle Lake, where no California woodpeckers were ever seen by us. To repeat, none of this species of woodpecker was seen by us east of about the western edge of the yellow pine belt (Transition life-zone).

Individual woodpeckers often were seen making a kind of flight the object of which we did not determine. A bird would fly in a nearly vertical direction from its perch for three meters or more and then commence an irregular swooping flight, finally coming back to the original perch.

Birds of this species were further observed regularly to fly out from perches and apparently capture passing insects. One group of eight or ten was watched, May 27, 1926, in a large valley oak near

Bloody Island. The birds were flying after insects and catching them in the air. Each woodpecker returned to the oak after each capture or attempted capture. Some were seen thus "flycatching" on December 25, 1927, at Elliott's. This same behavior was noted on April 6, 1928, at Cone's. There the birds usually went to a different perch after each flight.

On April 5, 1928, at six miles north of Red Bluff, a sycamore was found with six or more dead stubs in its top. These were filled with storage holes of the California woodpecker. A bird on one of the stubs was pounding, but the manner or result of its efforts could not be determined. Later, for five minutes the bird preened and picked at its feathers—even those of the tail—as it clung to the vertical perch.

At Silva's, April 13, 1928, two California woodpeckers were foraging, apparently for insects, "chickadee fashion" at the tips of twigs of large valley oaks. This was not just a short "try" but it was kept up for as long as the birds were watched (15 minutes).

Several woodpeckers seen at Elliott's on December 25, 1927, were thought to be feeding on fruit of mistletoe. Some were "flycatching" from the tops of walnut trees. Persons who lived in that neighborhood complained that these birds, in summer and fall, took much fruit and all the almonds from their orchard. The almonds were attacked green, punctured on the tree and the contents "sucked out," according to the accounts.

At Silva's, storage borings were seen in dead stubs of sycamore and cottonwood and one set was found in the bark of a large valley oak which still had living branches, although the heart of the tree had rotted long before. Six miles north of Red Bluff a large digger pine was found with borings from top to base. These were in the bark. Some of the lower holes, at least, contained rocks wedged in tightly. One hole held two stones. A near-by, dead blue oak contained many borings.

At Cone's, in 1911, complaints were heard that these birds bored through the shingles of houses and stuffed acorns into the cavities sometimes exposed.

Close to Elliott's, holes for storage were found drilled in some large fence posts. In one of these that was examined, most of the holes were enlargements of splits in the wood. In several of these, two or even three acorns were stored in a single cavity.

A tall, dead yellow pine near Payne Creek P. O. had storage holes on the main trunk from top to bottom and also on stubs of the limbs that remained. The wood in this tree was especially soft and rotten.

In the vicinity of Manton in late April, 1928, this kind of woodpecker was notably numerous among the charred and standing stubs of digger pine on the scrub-oak-covered land. Each of the stubs had from one to three nesting holes that appeared to have been made by birds of this species. Not more than two birds were seen at one stump. Two digger pine stubs that had storage holes from base to top were each in an opening removed from any oak or other tree. Around their bases were many acorns and pieces of shells of acorns. Most of the borings appeared to have been recently made and practically all of them held acorns or shells. Some of the nuts had cups attached. About half the acorns that could be seen from the ground had been emptied by smashing in the ends or sides, the shells being left in the borings. A few acorns were seen with small insect-made holes. One that was broken open by the observer held a perfect kernel. All the acorns appeared to be fresh, that is, of the previous year's crop.

One stretch of fence posts along a road close to Manton showed much evidence of the work of this species. For several rods every post was filled on all sides with borings that appeared to be fresh. Most of the holes contained acorns or empty shells of them, with the ends or sides removed, evidently by the woodpeckers.

At Cone's on April 24, 1928, several California woodpeckers were seen clinging at the entrances to nesting holes in dead stubs.

A female, taken May 24, 1924, from a group of four or five woodpeckers near Dale's, was not in breeding condition. This suggested that perhaps each year many individuals, possibly year-old birds, did not nest.

This woodpecker was especially numerous, on April 17, 1929, in the grove of large valley oaks at Cone's and also in the trees along lower Antelope Creek. One bird flew to a stub of a dead cottonwood and clung there with both wings outstretched for several seconds. Another one followed and held its wings in the same position. Both birds called as they perched thus.

Asyndesmus lewisi Riley

Lewis Woodpecker

Present at all seasons within the section below an altitude of 6000 feet; but irregular of occurrence both as to place and time. Specimens obtained at: Red Bluff, 300 feet, May 3, 1924; Dale's, 600 feet, December 24 and 30, 1924; Payne Creek P. O., 1600 feet, December 22 and 23, 1927; Gallatin's, 5200 feet, June 1, 1925. Observed at following additional localities: six miles northeast of Red Bluff, 500 feet, April 18, 1929; Turner's, 3500 feet, April 27, 1928; Battle Creek Meadows, 4800 feet, July 31, 1924 and 1925; Manzanita Lake, 6000 feet, June 10, 1926; Eagle Lake Resort, 5200 feet, June 12, 1929; Spalding's, 5200 feet, May 27, 1925, and June 17, 1928; Pappoose Valley, 5200 feet, June 11, 1929.

Weights of three December-collected males were 108.2, 108.2, and 113.2 grams. A male collected May 3, 1924, recorded as "exceedingly fat," weighed 137.7 grams. A laying female, June 1, 1925, weighed 115 grams.

Individuals of this woodpecker were definitely recorded in the following kinds of situations: at the edge of yellow pine forest; in lodgepole pine; in dead tree at edge of meadow; in blue oak; in sycamore top; in valley oak; in digger pine; on telephone pole amid chaparral; on fence post. Openness of the forest cover was a characteristic of all these places; either the trees were scattered, or the birds stayed about clearings or in the edge of the forest. The frequent observation of individuals flying off into the air as if after insects indicates that the birds may depend upon this as a regular manner of feeding. If this is true it might furnish an explanation of the almost universal choice of a perch where flights might be made, unimpeded by near-by trees, into the surrounding air.

While observed commonly in the neighborhood of Red Bluff May 3 to 6, 1924, no evidences of nesting there at that time were detected; the birds seen were not tied down to any location and were thought to be still *en route* to breeding grounds.

A pair of Lewis woodpeckers observed, May 27, 1925, near the western shore of Eagle Lake had a nest in a dead yellow-pine stub.

Usually only single birds or small groups of two or three individuals were observed at one time. The largest number observed together at once was twelve. That group was seen near Mineral on July 31, 1924; it is thought that the species was in that locality only a vagrant.

Newberry (1857, p. 90) says of this species that he first saw it, the last of July, 1855, "near Lassen's Butte . . . . , flying high in the air, when its flapping wings and its seemingly jet black color, led me to think it a crow diminished in size by distance." This comment can be made quite as aptly today as seventy-five years ago.

Sphyrapicus varius nuchalis Baird

Red-naped Yellow-bellied Sapsucker

A single bird (no. 45616) was collected, September 26, 1924, at a spring on Slate Creek, 5700 feet. It was a female and weighed 60.6 grams.

Sphyrapicus varius daggetti Grinnell

Sierra Nevada Red-breasted Sapsucker

Found in the mountains of the section in summer between Lyman's and Gallatin's; in winter, part, at least, of the population descends as low as the valley of the Sacramento River. Specimens obtained from the following localities: Dale's, 600 feet, December; Lyman's, 3300 feet, June; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet, September 17 and 18, 1923; Warner Creek at 6600 feet, September 26, 1923; Gallatin's, 5200 feet. Additional localities, where the species was observed only, are as follows: Cone's, 270 feet, April 6, 1928; Payne Creek P. O., 1600 feet, December 22, 1927; Turner's, 3500 feet, April 28 and 30, 1928; around Mineral, 4900–6500 feet; Summit Creek, 5200 feet; Wilson Lake, 5100 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet.

Weights of three December-collected males were 47.4, 54.0, and 54.7 grams. A male from near Mineral, June, and a female from near there, May, weighed 47.5 and 52 grams, respectively. A female from near Eagle Lake in May weighed 53 grams. Three June-collected females weighed 41.2, 45.9, and 49.2 grams. A male, July, weighed 48 grams. Weights of three females taken in September on Warner Creek were 40.1, 50.1, and 52.4 grams.

Plant species in which individual red-breasted sapsuckers were observed are as follows: sycamore, buck-brush, live oak, blue oak, black oak, digger pine, yellow pine, white fir, red fir, and aspen. In addition, birds were seen clinging to burned stumps, and once one was seen on the surface of a lava boulder. Borings made by this bird were definitely noted as in the bark of digger pine, red fir, and buck-brush. On one occasion two birds were seen perching crosswise on small twigs of a little tree.

On December 22, 1927, near Payne Creek P. O., much evidence of the work of this bird was seen on the stems of buck-brush. There were rings of punctures mostly running together into complete or partly complete girdles. The individual punctures where distinct were rectangular, horizontally nine by seven millimeters. The bark was thin, only one to two millimeters thick. Height of the girdles above the ground in four cases was 84, 120, 110, and 85 centimeters; width of girdles vertically, 70, 52, 45, and 34 millimeters; diameter of stems at girdles, 40, 43, 73, and 26, respectively. The freshest work was always at the top of each girdle and there the surface was wet with sap. At the bottom, each girdle was dry; but all were the work of the current season. The yellowish, debarked girdles showed conspicuously on from one to four stems in each of the otherwise dark clumps. The affected bushes were in a narrow tract about 100 meters long. Blue oaks and digger pines were close around, but no workings could be found on them.

At Summit Creek, on the evening of June 21, 1924, a sapsucker was observed to fly into the air repeatedly and capture slow-flying termites.

One observer recorded that a male of this species had a loud, barking note given several times in succession (Grinnell, MS). Another observer ascribed to the note heard by him a wild, screaming quality (Hunt, MS).

On the west side of Eagle Lake a pair of red-breasted sapsuckers was found, May 28, 1925, nesting in a live yellow pine.

In 1905, Sheldon (1907, p. 188) found this sapsucker at or near the southwest end of Eagle Lake; he obtained ''two juveniles and one adult'' there on July 27.

A nest containing young birds was seen, June 5, 1926, in a hole in a burned stump one-fourth of a mile southeast of Manzanita Lake. The nest-hole was close to six meters above the ground. Both birds of the pair were carrying food to the young in the nest. For ten minutes they made frequent trips and did most of their hunting within 100 meters of the nest. One adult entered the hole with food while the observer was standing on the ground directly below.

On June 12, 1928, on Battle Creek Meadows, two adults were assiduously feeding weakly ''whinnying'' young, in a nest hole bored that year in the trunk of a live aspen and five meters up. Each adult bird was on the job, alternately, bringing food and carrying away excrement each round trip.

Just north of Butte Lake, on June 20, 1926, a nest hole was seen twenty-five meters above the ground in a dead pine. Adults were feeding young which made a great commotion with their loud cries. When a parent appeared with food the cries ceased for a moment and then started again with even greater vigor.

Sphyrapicus thyroideus thyroideus (Cassin)

Pacific Williamson Sapsucker

Resident in the section, though rather sparingly, from the vicinity of Mineral eastward as far as Eagle Lake. Following localities represented by specimens: Mineral, 4900 feet (September 10, 1916, and December 20, 1927); Manzanita Lake, 6000 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Willow Lake, 5600 feet; Spalding's, 5200 feet (October 14, 1923). Observed also at following additional localities: above Soupan Springs toward Lassen Peak, at 7500 feet; Prospect Peak at 7500 feet; Snag Lake, 6300 feet; Eagle Lake Resort, 5200 feet.

Townsend (1887, p. 206) records taking a specimen "at the eastern base of Mount Lassen early in June, 1884."

Weights of two males, taken in June and September, were 49.5 and 50 grams, respectively. Three females, a juvenile, July 23, and two adults, September and October, each weighed 50 grams. An immature female, September 10, weighed 60 grams.

At 7500 feet altitude on the trail from Soupan Springs to Lassen Peak, an example of the work of this woodpecker was found on May 17, 1924. The punctures in the trunk of a silver pine were in vertical rows, extending upwards about one and one-half meters, from a height of a little over two meters. There were three parallel rows of transverse incisions all the way, and at one level, near the bottom, there were eleven vertical rows. The punctures were about six millimeters deep; the septa between the vertical pairs of punctures were thin, and in places as many as four pits ran together. Between the series laterally there was more space, twelve to twenty-five millimeters. The pits were fresh and bleeding.

Near Eagle Lake, on June 16, 1928, a yellow pine 60 centimeters in diameter bore abundant drillings in short horizontal series from within one meter of the ground up to fully 25 meters. There was much old as well as freshly streaming pitch, and a female Williamson sapsucker kept close about.

On the east slope of Prospect Peak at about 7500 feet altitude, on June 28, 1928, a female of this sapsucker was seen at a nest hole fully 20 meters above the ground near the tip of a broken-topped but basally living red-fir trunk. The behavior of the bird indicated that there were young within the nest cavity.

Dryobates villosus orius Oberholser

Modoc Hairy Woodpecker

A resident throughout the higher, forested portion of the section; recorded sparingly west to Dale's, and east, at least in autumn, to near Termo. Specimens represent the following localities: Dale's, 600 feet; Inskip Hill at 1800 feet; Payne Creek P. O., 1600 feet; Lyman's, 3300 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet; Termo, 5300 feet. Presence was established by observation at the following additional localities: Manton, 2300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Lake Helen, 8200 feet; Morgan Hot Springs, 5000 feet; Wilson Lake, 5100 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Gallatin's, 5200 feet.

Weights of three December-taken males were 61.8, 62.8, and 68.9 grams. A female, December, weighed 53.1 grams. A June-collected male weighed 73 grams. Four females in June weighed 57.9, 58.4, 65.4, and 66.8 grams. A male and a female in September weighed 63.1 and 56.1 grams, respectively. Weights of five October-taken males were 70.0, 72.3, 73.8, 76.4, and 78.1; of one female, 64.5. The weights here given indicate that in this species males consistently weigh more than do females.

This woodpecker foraged over the trunks and larger limbs of many kinds of trees both in the forests proper and where there were a few trees or restricted tracts of trees in the mainly unforested parts of the section. Much of each bird's time was spent on coniferous trees, either living or dead ones, but nesting excavations were many of them in trunks of deciduous trees (fig. 48). Aspens and cottonwoods, dead at core, seemed to be preferred nesting trees, although other kinds were also used. Nest holes, when in conifers, were made in dead and decaying trunks or stubs. (See fig. 136.)

Examination of the stomach of one bird, as well as observation of other foraging individuals, indicated that the food is gleaned largely from crevices in the bark, which may be opened up somewhat, rather than by drilling through into the wood.

At the margin of Wilson Lake on May 24, 1927, a nest of the hairy woodpecker was found in process of construction. The south-facing entrance was nearly three meters up in the trunk of a live aspen, rotten at the heart. A bird was flushed from the cavity and there were fresh chips about beneath it. In the same tree was an older woodpecker hole occupied by tree swallows.

Another nest found in that vicinity on the same day contained five fresh eggs. This nest was in an aspen trunk thirty centimeters in diameter; the outer shell was twelve millimeters in thickness and alive, but the tree otherwise was decaying and with numerous bracket fungi growing up and down the trunk. The nest entrance faced the southeast, the direction in which the trunk slanted slightly. The ground beneath was strewn with fresh chips. Measurements taken at this nest were as follows: lower lip of entrance, two meters above the ground; transverse diameter of entrance 43 millimeters at surface of the bark (12 mm. thick) and 40 millimeters at the surface of the sound wood shell; at lower lip of hole, bark was chipped away so that the vertical height of orifice at bark surface was 70 millimeters; at wood surface, height of orifice was 45 millimeters; horizontal depth of excavation at level of lower lip of entrance, 130 millimeters; greatest diameter of nesting cavity midway of vertical portion, 97 millimeters; depth of cavity from level of lower lip of entrance to chip strewn surface on which eggs lay, 260 millimeters.

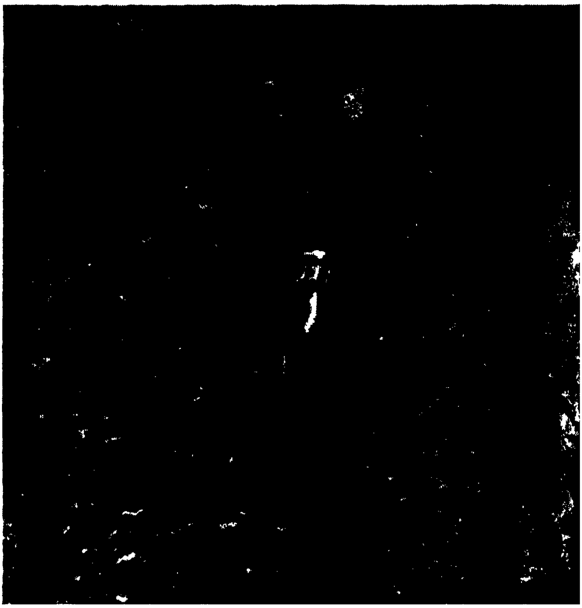


Fig. 136. Modoc hairy woodpecker (*Dryobates villosus orius*) clinging at entrance to nesting cavity in dead yellow pine trunk. The parent birds upon arriving usually looked about from this position just before taking food to the young birds inside the nest. Photograph taken June 1, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4660.

The female was brooding when the nest was discovered. When the tree was pounded upon the bird came up only far enough to show the bill and face. Finally it left, but only after a good deal of chopping had been done at the trunk.

Near Mineral on May 27, 1927, a newly excavated nest-hole of this woodpecker was found nearly three meters up in a live-shelled aspen. The entrance was on the southwest side of the trunk. Another nest, similarly located, was noted on June 2. The male was seen at this nest and there were quantities of fresh chips beneath. Small young were heard in this nest and, on June 16, both parents were about and solicitous.

Near Eagle Lake Resort on June 12, 1929, an adult was feeding a nestful of young woodpeckers in a cavity three meters up in a yellow-pine stub close to the lake. The nest hole had been freshly cut. Only the female was seen to carry food. The young were large enough to be fed without the parent entirely entering the cavity. When the observer walked near the nest stub the parent became much excited and flew about calling loudly for several minutes. The young birds called when the parent came with food.

Nests containing young hairy woodpeckers were found on the following dates: Spalding's, May 31, 1925; northeast of Mineral at 6000 feet, June 8, 1928; Manzanita Lake, June 8, 1926; Battle Creek Meadows, June 12, 1928; Butte Lake, June 20, 1926. In the case of each of the last three nests the young birds called loudly, and the parents showed concern when the observer closely approached the nest tree.

In the series of 21 specimens of the hairy woodpecker obtained, we are unable to find differences significant of other than individual or seasonal variation as between birds from the westward of Mineral and birds from the McDonald Peak region, a little northeast of Termo. All, by average of characters, fall under the subspecific name *orius,* rather than the western ones showing marked tendency toward *hyloscopus,* as might have been expected. The transmontane continuity of range, as well as the evident high zonal position of this woodpecker, may be called into account for the facts found.

Dryobates pubescens turati (Malherbe)

Willow Downy Woodpecker

A resident, in small numbers, in the western portion of the section; found in the breeding season up to an altitude of 2300 feet (at Manton), in winter up to 4900 feet (at Mineral). Specimens obtained at the following localities: Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; eleven miles east of Payne Creek P. O., at 3500 feet, December 21, 1927; Mineral, 4900 feet, December 21, 1927, and April 19, 1929. Observed also at Coyote Creek, 270 feet, and at Silva's, 270 feet.

A male taken in December weighed 25.8 grams. Weights of four December-collected females were 23.3, 24.5, 24.8, and 26 grams. Two males and two females, late May and early June, weighed 26, 29.1, 24.4, and 25.1 grams, respectively.

Downy woodpeckers were seen most often close to streams and in orchards. Their forage places included the limbs or small trunks of willow, alder, cottonwood, sycamore, valley oak, blue oak, digger pine, and yellow pine trees.

Young birds just out of nests were seen at Dale's on May 31 and June 2, 1924.

This woodpecker was present in the section in such small numbers that fewer than fifty individuals all told were observed in our work there.

Dryobates pubescens leucurus (Hartlaub)

Rocky Mountain Downy Woodpecker

A downy woodpecker (no. 44384, collected by J. Dixon) obtained at Spalding's, 5200 feet, October 14, 1923, belonged definitely to this subspecies. It was a female which weighed 24.1 grams; wing 101.0 mm., tail 63.0, bill from nostril, 13.9. The lower surface of the body is white, and the black barring on the outer rectrices is reduced to spots—characters of *leucurus* as compared with *turati*. A skin in the museum of the California Academy of Sciences (female, no. 26360, collected by J. Mailliard), taken at Bogard Ranger Station, 5500 feet, September 8, 1923, is fairly intermediate in characters between the two races. No definite evidences of breeding of downy woodpeckers were found by us anywhere in the Great Basin portion of the section; whether the above two birds were more than mere transients or winter visitants is not known.

Downy woodpeckers that were seen in the stub-forest belt at the south end of Eagle Lake, June 12, 1929, and in the willows along Secret Valley Creek, June 15 and 16, 1929, were thought to be of this race. However, no specimens were preserved.

Dryobates nuttallii (Gambel)

Nuttall Ladder-backed Woodpecker

A resident, encountered frequently in the section west from Manton; highest altitude of observed occurrence, 3000 feet. Specimens represent the following localities: Red Bluff, 300 feet; Dale's, 600 feet; Manton, 2300 feet. Additional localities, where the species was observed only, are: Blue Tent Creek, 350 feet; Coyote Creek, 270 feet; Silva's, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; Elliott's, 1000 feet; Inskip Hill at 3000 feet; Payne Creek P. O., 1600 feet.

Weights of two males, taken in December, were 37.6 and 40 grams. Two males and a female, collected in May, weighed 38, 38.7, and 36.2 grams, respectively.

Trees that this woodpecker foraged over were sycamore, cottonwood, valley oak, blue oak (most frequently), digger pine, yellow pine (rarely), and orchard trees. On June 3, 1926, one was seen feeding on cherries in an orchard near Manton.

On April 6, 1928, a male was watched digging a nest hole in a sycamore at the edge of a stream at Cone's. The hole was close to twelve meters above the water of the creek. The bird would enter the hole, peck five to fifteen times, as indicated by the jerking tail, then back out and drop some chips. Clinging to the stub it would peer about for a few seconds, then go back and pound some more (Linsdale, MS).

Xenopicus albolarvatus albolarvatus (Cassin)

Northern White headed Woodpecker

Present throughout the year in the mountainous portion of the section from an altitude of 3300 up to 6800 feet; but not noted east of the southwestern end of Eagle Lake. Specimens were obtained at: eleven miles east of Payne Creek P. O., 3500 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Drakesbad, 5500 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet. Observed in the following additional localities: Lyman's, 3300 feet; Turner's, 3500 feet; Kelly's, 5200 feet; Gallatin's, 5200 feet.

A male taken in May weighed 69 grams. Weights of three males, June, were 59, 60.4, and 60.7 grams; two females, 54.5 and 57. Three October-collected males weighed 58.4, 60, and 61.2 grams; one female, 58.8. Three young birds, partly feathered but still in the nest on June 17, weighed 53.5, 54, and 55 grams. Weights of males appear to be greater than weights of females in this kind of woodpecker.

Records of the white-headed woodpecker were nearly all of birds seen on coniferous trees, mainly yellow pines, or on dead or charred stubs or stumps of them. Often individuals were seen foraging over the bark on main trunks of large trees. In such places because of their quietness the birds were easily overlooked. The suggestion is made that charred places on the lower portions of the tree trunks are so generally present within the range of this black-bodied woodpecker that some degree of concealing value might pertain to the bird's style of coloration.

It was further observed that in usual pose, either when foraging or when digging or inspecting a nest hole, the whole back of a bird (either sex) appeared to a nearby observer solidly black, clear to the top of the head. The white showed only as a very narrow rim or border anteriorly around the black of the head. (See fig. 137.) It can be inferred, we think, that the white of the face when in this, its usual position, is so disposed as to reflect from its curved surface the greatest amount of light possible upon the surface under inspection, or into the hole into which the bird is looking. This, then, would

Fig. 137. Adult northern white-headed woodpecker (*Xenopicus albolarvatus albolarvatus*) clinging to entrance of nest cavity in aspen trunk. The bird was carrying food to young in the nest. Shows extent of black when bird is viewed in dorsal position. Photograph taken July 1, 1925, near Gallatin's.

be a similar function of the white to that observable in the case of the cañon wren; only in the woodpecker, which uses its bill in a position at right angles to the surface scrutinized, the white, to insure maximum service, must extend up over the forehead and above the level of the eyes. At the same time the concealing black of the bird's dorsal surface must cover all of the area of the bird exposed to the view of the potentially inimical observer at more or less distance.

The behavior of a bird in getting a drink of water was watched on June 19, 1925. In mid-afternoon one flew down from a yellow pine to some shallow, running water in an open roadside near Mineral. It alighted in a horizontal position on the ground and dipped its bill into the water six times. After each dip the bird raised its bill skyward at an angle of fully eighty degrees from the horizontal. After drinking, the bird then flew to a prostrate log, and foraged horizontally along its lower curvature.

On the southern border of Eagle Lake, on June 11, 1929, a white-headed woodpecker was seen to fly from the water's edge where it had been bathing. The bird lit on the vertical trunk of a yellow pine and shook water from its feathers. When it flew on, the flight was noticeably laborious and heavy.

On May 9, 1927, near Mineral, a male white-headed woodpecker was just beginning excavation for a nest in a yellow pine stump. The hole then was only about 25 millimeters deep horizontally. The site was so low and exposed that the observer thought it would likely not be completed. But the woodpecker was seen there daily. Until May 23, only one bird was seen in the vicinity of the nest and that one was always the male. On that date when "squeaks" were made by the observer several times within three meters of the stump, there was some delay and a bird, this time the female, protruded its bill and head far enough to expose a blinking, black-appearing eye. After a pause while it intently scrutinized the intruder, the bird scratched its way to a "take-off" position and flew off low over the ground and up into a pine. After calling a few times it flew off into the woods quietly. The behavior of the female indicated that it was either laying or already brooding.

A considerable quantity of "chips" had accumulated on the ground at the base of the stump. The nest hole was on the south side of the stump, which leaned a little in that direction. The site was at the edge of a small seepage meadow. The sawed-off stump was 67 centimeters high and 68 centimeters across. The lower lip of the nest entrance was only 49 centimeters above the ground. The opening was 45 millimeters in transverse diameter and 41 millimeters in vertical diameter. The horizontal depth to the back wall of the cavity from the lower lip of the orifice was 142 millimeters.

On June 15 when this stump was tapped with a pebble a chorus of low-pitched "words" sounding like "rhythm" was heard from the nest. The age of the young was estimated at five days. No parent was seen about.

Another partly constructed nest was found close to Mineral on May 15, 1927. The male appeared to be doing all the digging. The female came once and after some "side-stepping" and "whickering" soon went off. On the morning of May 17, the site was visited again. A woodpecker was heard calling in the distance. The bird came nearer and flew to a neighboring tree, calling frequently. After foraging some, this bird, which was the female, flew to the nesting stub and "hitched" down to the nest hole, where it clung to the lower lip of the orifice and put its head in several times but did not dig. The female kept calling; presently it was answered by a bird in the distance, then nearer; then the male appeared and flew to the stub and hitched down to the entrance. The female moved off to the right and flew away, giving the "whicker" note. The male started to dig.

An unfinished nest was found, May 31, 1925, near Spalding's. The cavity was four meters up in the trunk of a dead-topped aspen (fig. 137). On June 3, there were three eggs in the nest. On July 1, the young woodpeckers, by this time half-grown, were being fed by the parents, mostly by the female. Food was brought at intervals averaging fifteen minutes each. The birds foraged at distances up to a quarter of a mile away from the nest. The female carried away the feces.

On July 11 the female seemed to be coaxing the young from this nest. When the young woodpeckers stuck their heads out of the cavity, the parent would move away from the entrance and call, although it remained on the tree trunk. When a person shook the stub two of the young birds flew out and went thirty meters before coming to the ground. When placed on a tree trunk the birds could move freely upward or downward. Within a few minutes one of the young birds could fly so well that it successfully evaded capture by the observer.

In the stub-forest at the south end of Eagle Lake a nest was seen on June 11, 1929. The cavity was one meter above the ground in a low stub close to the lake. The entrance was 40 mm. high by 45 mm.

wide. The horizontal depth of the cavity to the outside of the wall was 155 mm. Depth of the cavity from the lower lip of the orifice was at least 300 mm. An adult was feeding large young, in the nest, which called loudly. Foraging was done mostly back in the pine woods. Usually the bird did not fly directly to the nest cavity but first perched for a few seconds on an adjacent tree. The excavation had been made at some previous season as the cut and exposed surface of the entrance was weathered in contrast with the freshly cut wood of a cavity that had been started recently in the same stub.

On the next day a pair of woodpeckers was seen feeding young in another nest in this same vicinity. The site was similar to that of the first one found. The entrance to this one measured 40 by 40 mm.

In a snag at Summit Creek a nest containing three partly grown young was found on June 17, 1924. Both parents stayed in the vicinity and called excitedly while the nest was examined.

Two adults were feeding young, June 19, 1926, in a nest two meters above the ground in a dead stub close to Butte Lake.

Picoides arcticus (Swainson)

Arctic Three-toed Woodpecker

Found sparsely in the main mountainous portion of the section from Battle Creek Meadows east to near Merrillville; altitudes of known occurrence vary from 4800 to 8200 feet. Specimens represent the following localities: three miles northeast of Mineral, 6500 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet. Also observed at Battle Creek Meadows, 4800 feet; near Mineral at 5200 feet; Lake Helen, 8200 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet; near Merrillville at 5600 feet.

Townsend (1887, p. 205, and MS) obtained two specimens "in the dense forest east of Mount Lassen," June 5 and 15, 1884. In 1905, Sheldon (1907, p. 188) saw juveniles of this woodpecker at or near the southwest end of Eagle Lake and obtained an adult pair on July 14.

A male and two females, collected in June and July, weighed 73.5, 63.4, and 65.1 grams, respectively. Weights of five males in late September were 61.3, 68.2, 68.6, 72.2, and 88.1 grams. A female, September, weighed 71.3 grams.

Several three-toed woodpeckers were observed in September, 1923, at work on red firs in the vicinity of Warner Creek at 6600 feet altitude. The red firs in that neighborhood were apparently badly infested with wood-borers. On one area 20 by 20 meters eighteen trees, each more than 15 centimeters in diameter, were counted, six of which had been killed, presumably by wood-borers, within one year.

One of these woodpeckers was watched as it moved slowly up a tree trunk. It stopped to knock off a piece of bark with a sidewise (glancing) blow of the heavy bill. This was repeated several times. Then the bird began to drill in earnest and the tapping could be heard by a person more than thirty meters distant. The blows were delivered rapidly, about two per second. Between three and five minutes were required to bore through the bark, in this instance twenty millimeters thick. Then after a few moments of probing the bill was withdrawn and was seen to hold a white larva which was quickly eaten.

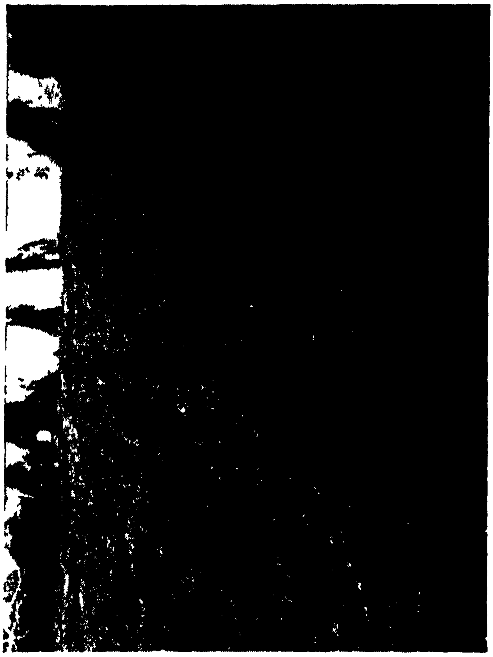


Fig. 138. Holes made through bark of red fir by an arctic three toed wood pecker (*Picoides arcticus*) in excavating wood-borer larvae. Photograph taken September 28, 1923, near Warner Creek at 6600 feet altitude. Mus. Vert..Zool. no. 4170.

The stomach of one individual from Warner Creek at 6600 feet altitude contained ten wood-borer larvae, each close to twenty millimeters in length.

On one tree thirty-five centimeters in diameter an area of bark thirty by sixty centimeters was punctured completely through by twenty-two holes each leading to the tunnel of a wood-borer (fig. 138). The holes were twelve by twelve millimeters across by twenty deep.

It appeared to the observer (Dixon, MS) that many of the still living trees in that locality had been saved from complete destruction by the insects, by the activity of this woodpecker.

Near Merrillville, June 25, 1925, Mr. Ralph Hoffmann shot a young three-toed woodpecker not long out of the nest. It was following the male parent and begging for food. However, during the observation the adult gave no food to the young one.

At 6500 feet altitude northeast of Mineral a male was shot June 26, 1925, from a red fir twenty meters above the ground. The bird's abdomen was glandular, thus indicating that a nest was near-by and that the male sex in this species does at least part of the brooding upon the eggs.

The opportunity is here offered, with new material available, for looking into the status of the supposed subspecies, *Picoides arcticus tenuirostris,* described by Bangs (1900, p. 131) but subsequently synonymized by most other authors including Ridgway (1914, pp. 298–302). Through the courtesy of the officers of the Museum of Comparative Zoology, Cambridge, we are privileged to have before us three out of the four specimens, from Fort Klamath, Oregon, which served as the basis of Bangs' description. Also from the same source we have twenty other examples from various localities in Maine, New Brunswick and Alberta. In the Museum of Vertebrate Zoology there are, besides the nine specimens from the vicinity of Lassen Peak, fifteen from other localities in California, and six from Oregon, British Columbia, and Alaska.

The characters which Bangs gave for *P. a. tenuirostris,* as compared with "true *P. arcticus,*" are: (1) averaging "a little larger"; (2) nasal plumes with less of white, "blacker"; (3) bill, in shape, different, "extremely slender." Our scrutiny of the series now at hand leads to the following comments concerning these features.

As to size: Bangs evidently took wing length as an index of this. Doing the same we obtain the figures as follows. Twelve California-taken males average 129.1 mm. (123.5 to 132.6); ten Eastern males average 128.4 (124.6 to 134.8). Seven California-taken females average 126.6 (123.8 to 128.9); ten Eastern females average 123.9 (122.1 to 127.3). Ridgway (*loc. cit.,* p. 299) gives figures which show even less differences—only tenths of millimeters for females as well as males.

As to white about the face: This is represented not only by differences in amount of white mixed in the nasal plumes, but, correlatively, by more or less fine white streaking behind the eye. In this respect no Californian example reaches quite the extreme of white extension as shown in some Eastern examples; the majority of Californian birds show the "blacker" type of nasal plumes; but out of twenty Eastern birds seven are quite indistinguishable in this regard from average California birds.

As to shape of bill: The three Klamath birds, the same, plus the type, that Bangs had before him, do show the slenderest bills in our entire series, Western as well as Eastern. *If* California birds showed the same character to the same degree that the Klamath birds show there would be good ground for recognizing a subspecies separate from an Eastern one on this character alone. But, south in California, as far down the Sierra Nevada as the species is known to occur, bill size and shape is increasingly similar to, though not quite reaching, *on an average,* the condition in New England birds. A mid-bill narrowing *is* observable in the majority of California birds. But, again, as with the other characters, Eastern individuals can be picked out which are indistinguishable from Californian ones.

To sum up: We find a *tendency* toward the development in arctic three-toed woodpeckers from California, of the characters originally ascribed to *tenuirostris.* But this tendency is so faint, so much a matter of averages, so elusive when it comes to appraising individual specimens, that we conclude that the recognition of it in nomenclature would, at least at this time, serve no adequate purpose. *If* future increments of specimens from the Fort Klamath region of Oregon (and perhaps the Cascades to the northward) should show the extreme of characters exhibited by the three examples now at hand from there, then there might be ground for a different treatment of the case.

Tyrannus verticalis Say

Western Kingbird

A summer resident in the western part of the section below 600 feet altitude and also at a few localities east from Bogard R. S. Specimens collected at Red Bluff, 300 feet, and Little Willow Lake, 6200 feet, July 21, 1924 (probably only a post-breeding vagrant here). Observed at following additional stations: ten miles north of Red Bluff, 500 feet; Blue Tent Creek, 300 feet; Coyote Creek, 270 feet; Silva's, 270 feet, April 13, 1928; Cone's, 270 feet, April 6, 1928 (our earliest record seasonally); Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet, April 22, 1928; Bogard R. S., 5500 feet; Spalding's, 5200 feet; Gallatin's and north end of Eagle Lake, 5200 feet; Grasshopper Valley, 5300 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Box Springs, 5300 feet.

The male collected near Red Bluff, May 2, weighed 39.3 grams; the one from Little Willow Lake, July 21, also a male, weighed 44 grams.

Kingbirds were most often seen in the Sacramento Valley in the tops of isolated oaks or willows in fields, or on poles and fences. One bird perched on a dead limb at the edge of a pool and flew to the surface of the water after insects. At Dale's individuals were seen over the rocky mesa where there were a few scattering blue oaks. The single bird at Willow Lake was first seen on a blueberry bush in a meadow. From there it flew to a dead fir tree at the edge of the lake. In the neighborhood of Box Springs kingbirds stayed in a grove of aspens.

Townsend (1887, p. 209) records the first appearance, seasonally, of this bird, at Red Bluff, on April 5 (1884). Eggs were taken near the same place the middle of June.

At Coyote Creek on April 17, 1929, several were seen singly in flight northward as if they were migrating. The birds flew low over the ground and some would alight for a moment in a tree and then fly on. Others did not stop.

Along the middle western shore of Eagle Lake where kingbirds were numerous among the dead trees in which ospreys were nesting, the kingbirds did not molest, as it was supposed they might, or pay any attention to, their large neighbors. Kingbirds were more numerous than anywhere else in the eastern portion of the section, about the north end of Eagle Lake, where pairs were spaced out about every one-fourth mile, nesting, June 18, 1928, in isolated large junipers surrounded by sage-brush.

Kingbirds in the cottonwoods around the house in Petes Valley were especially noisy in the early morning even before sunrise. At mid-day on June 8, 1929, a bird was seen carrying material to a nest six meters up in a crotch of a tall dead cottonwood. During a heavy rain on June 9, no bird was on this nest, but one was seen beneath the sheltering foliaged branches of a living tree.

On June 13, 1929, a nest was seen near Spalding's. The site was three and one-half meters up in a broken place in a small yellow-pine stub. Three eggs, probably an incomplete set, were in the nest. Only one bird was seen near and it protested by calling loudly when the nest was approached.

Western kingbirds had young nearly ready to leave their nests at Box Springs on July 8, 1925.

Myiarchus cinerascens cinerascens (Lawrence)

Northern Ash-throated Flycatcher

Generally distributed in summer in the section below 3300 feet altitude; few records at extreme eastern edge of section. Following localities represented by specimens: Red Bluff, 300 feet; Bloody Island, 350 feet; Dale's, 600 feet; Lyman's, 3300 feet; eight miles southwest of Ravendale, 5600 feet. Observed at following additional localities: six miles north of Red Bluff, 350 feet; Cone's, 270 feet, April 16, 1928 (earliest seasonal record); Mill Creek, 260 feet; east of Payne Creek P. O., 2100 feet; Manton, 2300 feet; Secret Valley, 4500 feet; four miles northeast of Red Rock P. O., 5500 feet; Box Springs, 5300 feet.

Weights of summer collected males were 27.5, 28.1, and 29.2 grams. Females collected in June and July weighed 26 and 25.5 grams, respectively.

Ash-throated flycatchers on the low ground along the Sacramento River were seen in sycamores, in valley oaks, in live oaks, and about dead trees or hollow snags close to the river. On the higher ground to the eastward, as about Dale's, the birds noted were on the rocky mesa clothed scantily with grass and with a few scattering blue oaks and clumps of buck-brush. At Lyman's one was caught in a rat trap that was set on the ground. It was thought (Hunt, MS) that the bird had been foraging for ants.

A pair of these flycatchers at Box Springs acted as if they might be nesting in a grove of aspens (Dixon, MS). They were observed there July 9, 1925. At other places in the eastern part of the section this flycatcher was seen in or around junipers, willows, or sage-brush.

Townsend (1887, p. 209) noted the arrival of this flycatcher at Red Bluff, on April 25 (1884).

On June 19, 1929, an ash-throated flycatcher's nest was discovered on a rocky slope covered with junipers and sage-brush eight miles southwest of Ravendale. The cavity was three meters up on the east side of the main trunk of a juniper. The horizontal diameter of the entrance was 60 mm.; its vertical diameter, 65 mm. The cavity was 24 cm. deep. There were eggs in the nest, but the number was not determined. An adult that was brooding flew off when the tree was climbed. The bird made no sound after the first note when leaving.

Sayornis saya saya (Bonaparte)

Rocky Mountain Say Phoebe

A phoebe of this race (male, no. 52776, collected by J. Linsdale) was taken April 10, 1928, ten miles north of Red Bluff. The bird was perched on a wire fence at a roadside and at the edge of a small clearing in the oak-covered hills. Its weight was 20.7 grams. A specimen in the museum of the California Academy of Sciences (no. 26300, collected by J. Mailliard) was taken at Bogard Ranger Station, 5500 feet, September 6, 1923. The evidence, so far as it goes, indicates this subspecies to be a transient through the Lassen section.

Townsend (1887, p. 209, and MS) obtained several specimens around Red Bluff, March 11, 13, 26, and 29, 1884; and he remarks upon this species as "a common summer resident of the Upper Sacramento Valley"—which it certainly is not today. Indeed, we have no ground for believing that it breeds there now at all.

Sayornis saya yukonensis Bishop

Northern Say Phoebe

A Say phoebe was shot by J. Linsdale from the top of a boulder whence it had flown from the roadside at 700 feet altitude, seven miles east of Red Bluff, December 30, 1927. It was subsequently found to belong to the above subspecies, on the basis of its relatively dark general coloration and large size (wing, 106.2 mm., tail, 83.5 mm., weight, 25.4 grams). Although not definitely so determined, this bird is thought to have been a male. Other Say phoebes that may or may not have belonged to this race were seen in winter close to Red Bluff, on fence posts and telephone poles at roadsides.

Sayornis nigricans semiatra (Vigors)

Northern Black Phoebe

Resident in western part of section below 1000 feet altitude. A specimen collected at Dale's, 600 feet. Observed at following localities: Red Bluff, 300 feet; eight miles northeast of Red Bluff, 400 feet; Coyote Creek, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Elliott's, 1000 feet.

A male collected on December 30, 1924, at Dale's was exceptionally fat and weighed 19.4 grams.

Black phoebes were usually seen along streams, about rocks where largely shaded, about bridges, along vertical banks, or about buildings. Perches selected by this bird were usually near the ground, as in willows, on fences, or on stones. One bird at Red Bluff on December 20, 1924, was flitting about the sunny side of a building.

On May 27, 1926, along Battle Creek near Bloody Island a black phoebe was observed to fly into the air and catch an insect within five meters of an observer. The insect was not large but for some reason it was released soon after it was captured and no attempt was made to recapture it. The insect flew on and the bird returned to its perch. It seems likely that this insect was released because it proved distasteful to the bird. Such examples of apparently selective feeding by birds are not often observed (Linsdale, MS).

A nest was discovered, May 25, 1924, under a low bridge across a then dry wash near Dale's. The home site was two meters above the bottom of the wash. Two young birds in the nest were ready to leave and one of them flew to a nearby tree when they were disturbed.

Empidonax traillii brewsteri Oberholser

Western Traill Flycatcher

A summer resident at scattered localities in western half of section. Collected at: Bloody Island, 350 feet, May 25 and 29, 1926; Dale's, 600 feet, May 21 and 23, 1924; Battle Creek Meadows, 4800 feet, June 29, 1925 (observed as early as May 25, 1927); Willow Lake, 5600 feet, July 26, 1924. Also observed at Mill Creek, 260 feet, and Manzanita Lake, 6000 feet.

Adult males collected in May weighed 12.2, 12.5, and 14.3 grams. One taken on July 26 weighed 9 grams. Adult females collected in June weighed 12, 12.7, and 13 grams.

With the exception of one bird that was shot in a blue oak near Dale's, May 21, 1924, and which was thought to be a transient, every individual seen, of this species, was in thickets of willows whether along streams or in such other moist situations as meadows and margins of lakes.

July 31, 1925, is the latest recorded occurrence in summer. Several were seen on that date on Battle Creek Meadows where, however, they undoubtedly remained until later in the season.

A nest that was found newly completed on June 15, 1927, at Mineral, held a complete set of three eggs on June 18. The rim was exactly one meter above the ground in forks of a vertical willow above a little meadow stream. Both birds of the pair were in the vicinity.

On June 19, 1925, a nest under construction was found two meters up in a crotch of a slender willow stem in the midst of an isolated clump in Battle Creek Meadows. One that was found not quite completed on June 20 held four fresh eggs on June 27. This one was in a dense willow jungle; rim only 104 centimeters above running water where entirely overgrown with matted willows. The nest was on slanting stems overtopped by fully two meters of lush willow growth.

Two nests each containing four eggs were found in willow thickets near Mineral, on June 29. One was insecurely supported amid upright small willow stems and leaves and was well shaded by lush green willow and alder foliage. Its rim was 1.4 meters above the ground. The second nest was only 100 meters from the first. It was 75 centimeters above the ground, supported by a slanting willow stem together with other twigs and leafage, in a rather open, low thicket but surrounded by taller growth of willow and alder.

In the cases of nests with eggs the males kept out of sight in the willows, but were heard to sing in the vicinity, from time to time, while the observer remained at the nests. The females showed active concern.

The picture formed by the above instances is of a strikingly restricted nesting niche for this flycatcher—as, also, forage niche, at least in the summer season.

Empidonax hammondii (Xantus)

Hammond Flycatcher

Recorded in summer in the mountainous part of the section from 4900 to 8200 feet altitude; in spring a transient through the low, western part of the section. Specimens collected at: Red Bluff, 300 feet, May 4, 1924 (observed also May 2); Manton, 2300 feet, April 20, 1928; vicinity of Mineral, 4800–5500 feet (several dates in June and July); Manzanita Lake, 6000 feet, June 11, 1926; Summit Creek, 5200 feet, June 18, 1924; Willow Lake, 5600 feet, July 24 and 26, 1924; Butte Lake, 6100 feet, June 18, 1926. Observed otherwise at two miles west of Black Butte, 6800 feet, June 29, 1924, and Lake Helen, 8200 feet, May 17, 1924; also, farthest east, at Bogard R. S., 5500 feet.

A male collected April 20 weighed 12.1 grams; one taken May 4 weighed 11.6 grams. Three shot in mid-June weighed 10.2, 10.2, and 10.9. Three adult females collected, in early July, weighed 9.5, 9.7, and 11.2. Average of all, 10.7 grams.

The first observation, seasonally, from within the known breeding range of the species is May 8, 1927, at Mineral. The following observations (by J. and H. W. Grinnell) all pertain to the vicinity of Mineral, including the ridge paralleling Martin Creek toward Brokeoff Mountain.

At eight o'clock on the morning of May 10, 1927, a male Hammond flycatcher was observed singing 15 meters up on a bare tip of a dead lodgepole pine in a tract of dead and living lodgepoles at the edge of Battle Creek Meadows. The song was similar to that of several Wright flycatchers that had been heard just previously, but it was less varied and of decidedly less volume. Three distinct parts made up the song, which was written down as follows: *seé wuz, wurzel, zweet*—uttered slowly, with much longer intervals between second and third parts than between first and second, like the rhythm in the song of the western flycatcher. Another individual, thought to be a female, was flying from twig to twig in living lodgepoles, keeping six to twelve meters from the ground, and uttering a location note, *quip* or *kip*, soft in quality, at frequent but varying intervals.

One pair of Hammond flycatchers that was observed repeatedly in 1925 in a strip of lodgepole pines near Mineral limited its activity to a radius of thirty meters of one place. Usually the birds stayed above the eight-meter level, but occasionally they foraged low. For example, one was seen toward evening to carry on its fly-catching down about the bases of pines and firs, and within rank ground vegetation, often going even to the ground itself to snap up, with a little bill-click, some insect. This bird continually uttered a faint, soft *pit*, characteristic of this species. Later, after the female had been shot, the *pit* was no longer heard, but the remaining bird's call was a rather sharp *seé-put* or *seé-pert*.

One singing bird that was watched June 24, 1925, had as its singing perch the very topmost snag of a dead-topped white fir. The height of the perch was estimated at forty meters from the ground. The bird continually shifted its body, most frequently the head, from side to side. The head was thrown back simultaneously with the utterance of the notes. The complete "song," given over and over again with monotonous regularity, sounded to the observer as follows: *sḗ-put* (uttered rapidly), *tsur-r-r-p* (roughly burred), *tsēēṕ* (rising inflection).

A nest of this species was found near Mineral on June 22, 1924. It was nearly thirty meters up on a horizontal sub-branch of a huge sugar pine. On the next day one of the parent birds was collected, so that the identity was established.

On July 2, 1925, another nest was found, in a living lodgepole pine on Battle Creek Meadows. It was discovered by keeping track of the movements of one of the birds until it went to the site and appeared, as it perched on the nest rim, to feed another bird. Subsequently, a bird that visited the nest was shot, and it proved to be a female with the skin of the breast glandular.

Upon climbing the tree, the collector found that the nest was, by actual measurement, 8.85 meters above the ground and 4 meters out from the trunk of the tree. It held four small young birds. The nest (preserved in the Museum, no. 2009) is of rather unexpected construction, in that three successive years' occupation of the site is in evidence. The lowermost of the three layers that are distinguishable is hard-packed, resistant to the touch, and fitted closely into the supporting crotch and against the accessory side branch; upon this is a less compact but also weathered layer about 20 mm. thick as viewed on the exposed surface; above this is the new, current nest proper with free rim showing about 20 mm. still higher. The color of this new and superimposed cup is, in sharp contrast to that of the other two layers, light brown because of its constituent material being of unweathered but dried coarse light-brown vegetable fibers and grass stems, mixed with blackish filaments of a lichen. This latest increment is well rounded and of close texture. The concavity is 44 mm. in diameter, depth 30; the total height of the entire structure is 80 mm., diameter the same. The main supporting branch, which was down-drooping at about a forty-degree angle, is 24 mm. in diameter.

A family of young, obviously just out of a nest, was watched July 8, 1925. They kept at a height of about ten meters above the ground, among the branches toward the center of a lodgepole pine. The young birds were well feathered except that their tails were not quite of full length. Both parents were in attendance. After the old female had been collected, the male alone fed the family. The young ones would, in turn, fly out after the parent and there would be a melee during which feeding apparently took place. The young birds gave a faint food call, *chlip.*

In conclusion, the summer niche of the Hammond flycatcher may be defined as follows: Canadian-zone woods, chiefly, where red fir, white fir or lodgepole pine, one or the other of these trees, predominates; forage beat customarily high above the ground; singing post lofty; nesting site high.

Empidonax wrightii Baird

Wright Flycatcher

Recorded in summer from 4800 to 6800 feet altitude, from the west end of Battle Creek Meadows east to the west side of Eagle Lake. Specimens obtained at the following localities: Mineral, 4900 feet, June, 1925 (observed first, seasonally, May 8 [1927] and thenceforth till August 3 [1925]); Manzanita Lake, 6000 feet, June 9, 1926; Summit Creek, 5200 feet, June 18 and 21, 1924; two miles west of Black Butte, 6800 feet, July 9, 1924; Gallatin's, 5200 feet, June 4, 1925. Observed also at many points around Battle Creek Meadows, 4800 feet.

Weights of adult males collected in June were 10.5, 12, 12.3, 12.5, and 12.5 grams, respectively (average 11.9). Weights of adult females collected in June and early July were 11, 11.7, 11.9, 12.1, 12.2, and 12.7 grams (average 11.9).

The summer habitat of this flycatcher was restricted to those slopes and ridges in the higher mountains where green chaparral made up the predominant or even exclusive type of vegetation. The presence of trees was not absolutely required, as shown by the occurrence of the species in the wide, treeless stretches of chaparral south and east of Manzanita Lake; yet, taking the whole Lassen range of the Wright flycatcher into account, we gain a picture of chaparral *with trees scattered through it,* as characterizing the average habitat. The bird appears to favor the presence of singing posts decidedly above the usual elevation of even the higher tips of the chaparral components. However, the major kinds of activity—foraging and nesting—were normally carried on within the branch work and foliage of the low bushes.

A Wright flycatcher that was feeding in surroundings characteristic for this species was watched at two miles west of Black Butte on the morning of July 9, 1924. The bird was flitting almost silently through the chaparral of manzanita, chinquapin, and snow-brush. It did not remain long on any one perch but kept in motion. While it was being watched this bird did not catch any insects in the air, but it picked off many from the leaves, twigs, and even from the ground. During the brief moments of perching, this individual had the upright posture typical of a flycatcher, and occasionally it gave its tail a slight downward, rather forward, jerk. The whole time was spent below the level of the top of the chaparral. The only notes that were heard were an occasional *tsip* or *creer,* almost too faint to attract the attention of a human observer (Hunt, MS).

Although the earliest nest found in the vicinity of Mineral contained a complete set of four eggs on June 15, 1925, the conditions at other nests indicated that some pairs had eggs one week or more earlier. In another nest there were three eggs and one young bird on June 21, 1924. On the next day there were four young birds in the nest. Another with four eggs that apparently had been deserted was seen on June 25.

In one nest that was observed, the fourth egg was laid in the middle of the morning of June 18, 1925. The bird was apparently sitting continuously from at least the time the second egg was deposited. The male sang from a perch high in near-by yellow pines. The brooding bird always left by ducking down and off through the chaparral, on the side away from the intruder. This nest was in a nearly upright clump of stems and twigs of snow-brush (fig. 139). The rim was 95 centimeters above the ground and the tallest sprigs of the bush were 49 centimeters directly above the nest. The nest site was in the middle of a rather open clump about five meters across, which formed a part of a general growth of this component of the chaparral on a gently south-facing hill slope. Within a thirty meter radius were standing four large yellow pines and a white fir.

One nest was 80 centimeters above the ground, supported by a stem and emanating twiglets of an open low clump of chinquapin growing on a southwest facing gentle slope (figs. 140 and 141). All the surrounding chaparral was of snow-brush and service-berry. Firs grew within a few meters. The nest was but slightly sheltered from above. The set of four eggs, that had been completed on June 17, 1925, was collected along with the two adults on June 20. When approached on the latter date the female was sitting closely. When she flew off close along the ground with soft *pits*, the male flew down from a fir to a bush fifteen meters off. The female had the abdominal skin thickly glandular, the male not at all. This, together with the fact that the female was sitting when the eggs were taken, pointed to the conclusion that the female was doing all the sitting, the male not participating.

Fig. 139. Wright flycatcher (*Empidonax wrightii*) perched on edge of nest in snow brush. Photograph taken June 17, 1925, at Mineral. Mus. Vert. Zool. no. 4609.

When the eggs were blown they seemed perfectly fresh, yet there was an appearance of drying. A considerable amount of time had been spent in photography at this nest. It was suspected that in this case, and possibly in others, photographic procedure had been disastrous by causing the eggs to be left exposed to the hot sun or to chilling air when the bird was off for a long period "getting accustomed

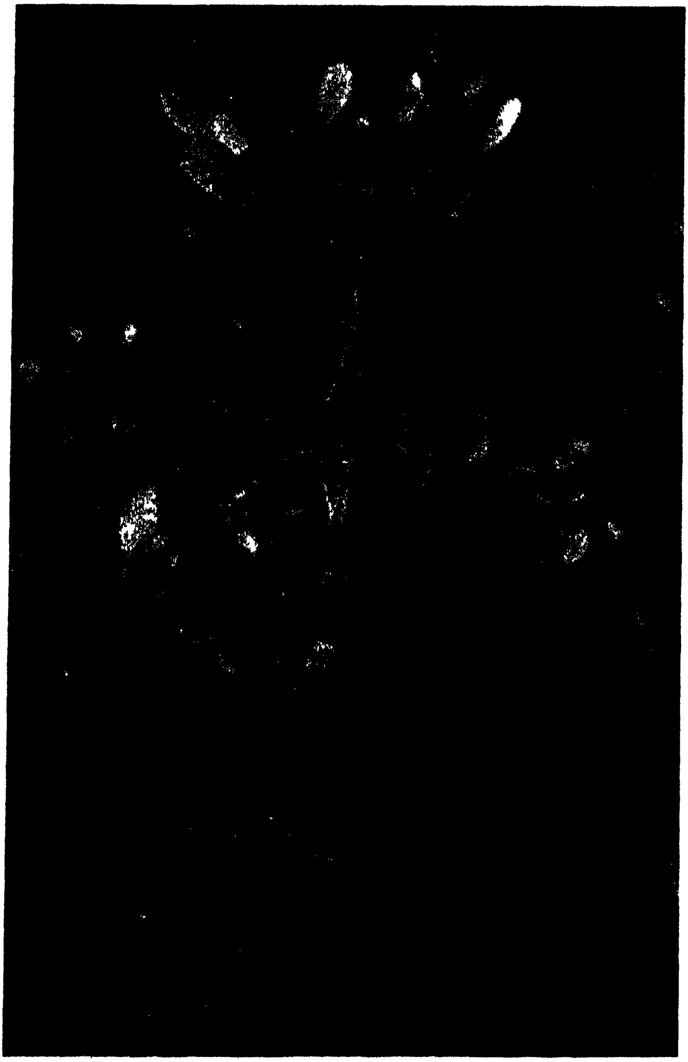


Fig. 140. Wright flycatcher (*Empidonax wrightii*) on nest in chinquapin. Examination of both birds of the pair indicated that the female did all the incubating. Photograph taken June 19, 1925, at Mineral. Mus. Vert. Zool. no. 4606.

to the camera.'' At 11 a.m. of the first day of incubation, when the sun's rays hit the nest, the female stood on the nest rim with spread wings and panted from the heat while shading the eggs.

On June 24, 1925, a nest was found near Mineral in an open stretch of chaparral with big yellow pines and white firs all about, and with little yellow pines close by. The nest itself was on a stem,

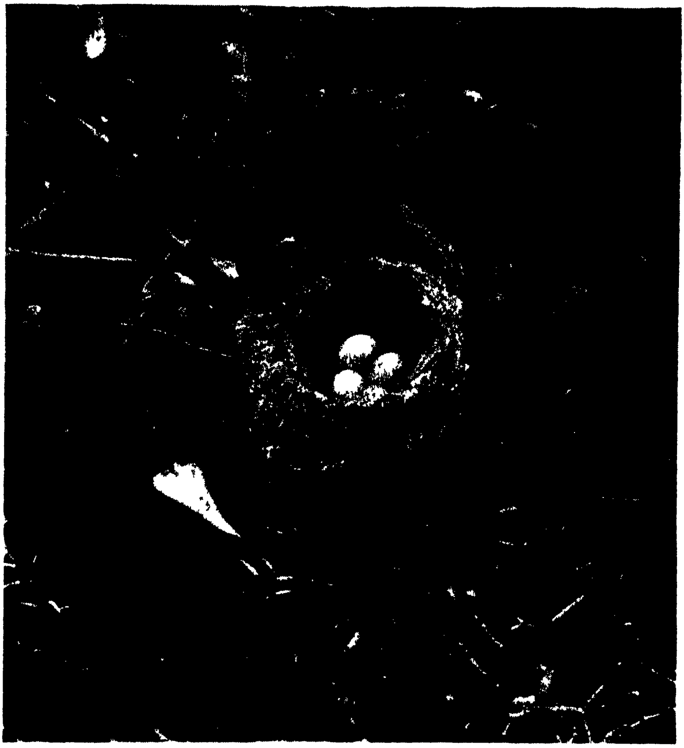


Fig. 141. Nest and four eggs of Wright flycatcher (*Empidonax wrightii*) in chinquapin. Photograph taken June 19, 1925, at Mineral. Mus. Vert. Zool. no. 4604.

and its network of twigs, of a very open, low clump of snow-brush. The rim was only 61 centimeters above the ground. The branch supporting the nest was dead, so that only the dead twiggery above gave shade—of an extremely dilute sort. The four far incubated eggs were unusual in that each had scattering fine dots, mostly about the big end, of dark brown. All the other eggs of the Wright flycatcher seen were immaculate.

A nest that was found barely begun on June 16, 1925, held three eggs on June 24 and a completed set of four on June 26. The female had evidently suffered an accident by which a lot of feathers on the back were lost. These were in process of replacement at the beginning of the period of incubation. It was thought that possibly nesting had been delayed due to the accident. This nest was supported in part by accessory twiggery on a nearly upright stem of snow-brush, its rim 113 centimeters above the ground. A living, leafy branch of the bush extended 60 centimeters above the nest. The site was in a "sea" of snow-brush on a gently sloping hillside. Two tall cedars 25 meters away were the nearest trees.

The activities of one pair of Wright flycatchers were traced through most of the season of 1925. The nest was placed among pendant twigs where a slender branch from each of two adjacent red-cherry bushes crossed one another. Its rim was 1.5 meters above the ground. The nest was on the east side of, and less than one meter away from, the trunk of a yellow pine. Snow-brush and firs grew within six meters. The site was close to where tracts of timber and snow-brush adjoined.

When this nest was first found, on June 15, it contained four eggs. All the eggs had hatched by June 17. The parents were watched as they fed the young on June 22. When disturbed, the brooding female left the nest, uttering a faint *put* of concern. The male from overhead called *see-put* very rapidly, and when it alighted on the edge of the nest to feed the young it gave a short, weak, musical trill. The female finally settled back on the nest to brood the young.

The young in this nest left it voluntarily (that is, not through fright) on the morning of July 5. Thus, the time spent in the nest by this brood was approximately eighteen days. On the afternoon of July 15, an observer was surprised to see a bird sitting on this same nest. When disturbed, the brooding bird flew to a near-by twig, and the nest was found to contain three eggs.

On July 28 two of the three eggs of this second set disappeared. When the nest was approached in the evening the bird flushed when the observer was yet six meters away. Usually it had been possible to approach much closer. On the next day the bird stayed on the nest closely and once the mate was seen to give food to the brooding bird. In the afternoon the remaining egg hatched. When the observers left Mineral on August 3 the single young one in the nest was still flourishing (H. W. Grinnell, MS).

Empidonax griseus Brewster

Gray Flycatcher

Found by us in the Madeline Plains portion of the section in the summers of 1928 and 1929. Twelve specimens collected three miles southwest of Ravendale and near Red Rock P. O. Weights of two adult males were 11.8 and 12.3 grams; of two adult females, 11.5 and 12.1 grams.

At the places on the Madeline Plains where this bird was found it lived among good-sized sage-bushes, averaging a little over one meter in height. There the gray flycatchers perched in the tops of the bushes, on wire fences, and on other objects of about the same height above the ground.

One of the notes of this species was remindful of a note of the Say phoebe except for being weaker.

A nest containing four young was collected along with the two parents on June 19, 1928, near Red Rock P. O. The nest, its rim 67 centimeters above the ground, was halfway up in a sage-bush, saddled on a branch four centimeters in diameter and surrounded by diverging twigs. The nest was so situated that the parent birds could fly directly to its rim from an approach close over the ground without encountering any twiggery. The parents were seen to do their flycatching among large sage-bushes and along a wire fence fully 150 meters away; their visits to the nest were silent and followed a low course zigzagging but slightly among the bushes direct to the nest (Grinnell, MS). In late July groups of full-grown young with their parents were seen frequently in that same vicinity.

There is a worn, apparently breeding adult skin in the museum of the California Academy of Sciences (male, no. 26110, collected by J. Mailliard) taken June 22, 1923, at Spaldings, 5300 feet, on Eagle Lake. This station marks just about the western limit at that latitude of the pure sage-brush area, and likewise probably the westernmost existence of the gray flycatcher at the same latitude.

Empidonax difficilis difficilis Baird

Yellow-bellied Western Flycatcher

A female (no. 48482, weight 11 grams) was collected May 30, 1926, at Manton, 2300 feet. One, probably a migrant, was seen in open coniferous forest near Kelly's, 5200 feet, on September 2, 1925 (Swarth, MS).

The bird collected at Manton was brooding on a nest of eggs that were nearly ready to hatch. The nest was one-half meter above the ground, on the broken side of a stump at the edge of the bed of Digger Creek. The bird behaved with much concern when flushed from the nest and stayed within fifteen meters of it. In construction, this nest (no. 2048 in the Museum) differs conspicuously from nests of the other Empidonaces in the section. It is loose in texture, irregularly bulky, and fresh moss predominates on its exterior surface. As a result of its situation against the surface of the stump, its shape is flattened, with the concavity closest to the flat side. The looseness of construction is, of course, consequent upon the presence of an extensive supporting area (Linsdale, MS).

Myiochanes virens richardsonii (Swainson)

Western Wood Pewee

Widely distributed in summer in the section up to around 7000 feet and as far east as the ridge just east of Horse Lake. Specimens obtained at the following stations: Red Bluff, 300 feet (observed as early as May 3, 1924); Bloody Island, 350 feet, May 29, 1926; Mill Creek, 260 feet; Dale's, 600 feet, May 20, 1924; Battle Creek Meadows, 4800 feet, May 16, 1927; Manzanita Lake, 6000 feet, June 10, 1926; eight miles southwest of Ravendale, 5500 feet, July 19, 1928. Observed also at practically every other station visited, during May, June, and July.

Weights of three males collected in May were 13, 13.7, and 17 grams; of a male in July, 14 grams. A female collected in May weighed 10.4; one collected in June weighed 16.4.

Wood pewees appeared to prefer, as perches from which to forage, the lower limbs of trees that grew in open stands; the favorite perches were from 10 to 15 meters above the ground. Trees that fulfilled these requirements in the lower portion of the section were sycamore, cottonwood, and valley oak. In the foothills the birds were seen in orchard trees. In the mountains any open stand of coniferous trees seemed to be suitable.

Around Eagle Lake, wood pewees were present not only at the southwestern, forested end where common, but also a few were seen, June 18, at the north end. Here the birds, two pairs specifically noted, had their centers of interest in large junipers surrounded by open expanses of sage-brush, though within 150 meters of the lake shore.

The drawling song was heard in July at Dale's and at Mineral after nearly all other birds had become quiet for the season. The latest recorded date of occurrence of this flycatcher in the section was September 2, 1925, at Kelly's.

A female that was collected June 13, 1912, at Mill Creek had an egg, ready to be laid, in its oviduct.

On June 15, 1925, at Mineral a wood pewee's nest was seen four meters above the ground on a dead, nearly horizontal branch of a lodgepole pine. The nest was at a fork of the limb which was 10 centimeters in diameter. Adults were seen taking food to young in another nest in this locality on July 8. This one was at the forking of a live lodgepole pine limb and was 10 meters above the ground.

At Bogard R. S., a nest was seen on June 22, 1929. The site was three meters up and one and one-half meters out on a horizontal limb of a lodgepole pine. The lining in the nest was not yet completed. The bird, perched nearby, flew after and chased individuals of other species out of the tree.

In Petes Valley on June 8, 1929, wood pewees, singly, were frequently seen, flying over the desert or perching on weed tips or fence posts. The birds, curiously out of place, were doubtless still in migration.

Nuttallornis mesoleucus majorinus Bangs and Penard

Greater Olive sided Flycatcher

Found in summer from an altitude of 3300 feet on the western slope of the section eastward as far as Eagle Lake. Specimens collected on upper Martin Creek at 6800 feet, June 8, 1928; at Eagle Lake Resort, 5200 feet, June 16, 1928, where also observed May 21, 1925; and at Gallatin's, 5200 feet, June 1, 1925. Recorded by observation additionally at: Lyman's, 3300 feet, June 11, 1924; Mineral, 4900 feet, as early as May 16, 1924, and May 14, 1927; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet, August 1, 1924; Wilson Lake, 5100 feet, May 18, 1927; summit of Prospect Peak, 8340 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet.

Two males collected in early June weighed 31 and 35 grams. A female that had been incubating eggs weighed 28.5 grams.

Perching places of the individuals of a pair, when once settled for the summer, were adhered to with impressive regularity. Three such stations in the vicinity of Mineral were: a large white fir, living but with summit spire and many of its lower branches dead, surrounded by clumps of smaller trees and open expanses of snow-brush; an extra tall and sparse limbed lodgepole pine in a tract purely of the same species of pine out on Battle Creek Meadows; one of several very large Jeffrey pines overlooking a sea of green manzanita on the ridge paralleling Martin Creek toward Broke-off Mountain. In each case it was observed that from the chosen stations forays for foraging were made out and *down* into the aerial spaces adjacent.

At Eagle Lake Resort a nest was found, June 16, 1928, 7.7 meters above the ground on a stiff, horizontal spray of the foliage of a young white fir. The supporting basement of coarse twigs was loosely spread so that the nest proper was easily seen from the ground. The sitting bird resented disturbance and kept flying at the intruder snapping its bill as it passed by in short back and forth onslaughts. The nest contained four eggs, considerably incubated. Collecting and dissecting the sitting bird, which was the demonstrative one, proved it to be the female. The mate was present but in the offing.

Otocoris alpestris rubea Henshaw

Ruddy Horned Lark

Present throughout the year at a few localities in the western end of the section, below 800 feet altitude (fig. 98). Specimens obtained at Coyote Creek, 270 feet, and two miles north of Dale's, 700 feet. Also observed seven miles east of Red Bluff near Tuscan Buttes, 750 feet, and near Mill Creek, 260 feet.

Weights of five males collected in December averaged 31.5 (30 to 34) grams. Five females collected in December averaged 29.1 (27.5 to 30.8) grams in weight. May-taken males weighed 28, 33, and 33.4 grams. A female shot in May weighed 28.8 grams; two, in June, weighed 27.5 and 28 grams.

The main habitat chosen by this race of horned lark within our section was the rocky mesa just above and bordering the Sacramento Valley on the east side (fig. 73). Whenever visits were made to this "waste" mesa land, in April, May, June, or December, this bird was conspicuous for its large numbers and for being almost the only one to live on that rocky type of ground. In winter the compact flocks would start up when disturbed and would fly so near the ground, below the horizon line, as to be nearly indistinguishable against the background of ruddy-hued earth and rocks.

In the spring when the birds were in two's, they were most often seen perched on tops of small pieces of lava such as were strewn over the prairie. From there an unobstructed view of the surrounding ground was to be had by the birds.

At a point two miles north of Dale's there was a shallow, recurrent lake which, in the spring while it still contained water, attracted horned larks to feed on the moist ground close to the water's edge.

Horned larks were found a few times in winter on the gravelly sheep pastures west of the Sacramento.

Because most of the horned larks seen in early April (up to April 17), 1928, were in pairs and because so many of them were singing, it was thought that nesting had not started by the middle of that month. In the late afternoon of April 22, one was seen flying high and giving a flight song. Some of the males seen on that date were unaccompanied by mates; the latter were probably on nests by that time. A female that was obtained May 23, 1924, was a sitting bird that recently had laid a full set of eggs. This represents a probable late nesting.

Townsend (1887, p. 210) found eggs at or near Red Bluff on May 4, 1884.

Otocoris alpestris merrilli Dwight

Dusky Horned Lark

This race of horned lark was present in numbers on appropriate terrain from Bogard R. S., on upper Pine Creek, eastward (fig. 98). Specimens were collected at the following places: Champ's Flat, 5400 feet, October 18, 1923; south side Eagle Lake, 5200 feet, May 16, 1925; five miles north of Fredonyer Peak, 5700 feet, October 7, 1924; Merrillville, 5200 feet, September 28, 1915; Petes Valley, 4500 feet, July; Jones', 5400 feet, July; Box Springs, 5300 feet, July. Additional localities where horned larks presumably of this subspecies were seen are as follows: Bogard R. S., 5500 feet, June 26, 1928; Slate Creek, 5700 feet, September 29, 1924; Termo, 5300 feet, September 23, 1924, May 19, 1918, and June 18, 1928; Red Rock P. O., 5300 feet, July.

Horned larks in the eastern part of the section were seen on ground where the cover of vegetation was slight. The birds frequented both cultivated land and unbroken land. Areas of sandy as well as hard ground were foraged over. Some individuals were seen on the mud flats which bordered the irrigation reservoir at Jones'. Single birds were sometimes seen perched in the tops of sage bushes.

On July 25, 1928, near Red Rock P. O., many horned larks were seen among small and scattered sage bushes. During the hot mid-day hours the birds sought shade beneath these small bushes.

A female that was shot on July 7, 1925, at Box Springs, was carrying a grasshopper in its bill. Young birds just out of nests were seen on that date in the neighborhood of Box Springs.

The westernmost place east of Lassen Peak where horned larks were found was the broad, open but forest-girt plain just east of Bogard Ranger Station, which is crossed by upper Pine Creek. Here, at 5500 feet altitude, on June 26, 1928, large numbers of full-fledged young as well as adults were seen along the road and out on the pasture lands. The population here was isolated by the encircling heavy forest; yet no more so than similar "colonies" farther east sequestered by stretches of heavy sage-brush or by juniper and sage-brush clothed hills.

Solicitous horned larks evidently with nests containing eggs or young were seen in Petes Valley, June 8, 1929, and on the flats near Bogard R. S. on June 22, 1929. On the latter date most of the birds seen were males.

Oberholser (1920, pp. 34–35) has newly named a race of horned lark *Otocoris alpestris sierrae*, with type from "head of Pine Creek, Lassen county," taken June 13, 1906, by A. S. Bunnell. The description is based on a total of eleven specimens, three of which are from the type locality (evidently the vicinity of Bogard Ranger Station, as referred to in our account above) and all taken the same day, while the remaining eight are of dates July 8 (from Donner, Placer County), August 16 (Summit, Placer County), September 11 (Bald Mountain, Shasta County), and the rest of winter dates, from localities in the upper Sacramento Valley.

Unfortunately, we ourselves failed to get skins of horned larks from the type locality of *sierrae*, although we observed that the species was common there in summer. The nearest locality represented by skins of horned larks before us is Champ's Flat, lower down on Pine Creek, part way toward Eagle Lake. Thence eastward localities are well represented as shown at the outset of this account.

Of our three specimens from Pine Creek, October ones all taken the same day and in unworn autumnal dress, one (no. 44402) conforms to Oberholser's characterization of *sierrae*. The other two we are unable to distinguish from what we have called *merrilli* without question, from all the rest of our east-Lassen stations as well as from many other localities in northeastern California, from Shasta Valley eastward. In other words, just one specimen of "*sierrae*" is before us, and we are not even sure that this, any more than the two associated "good" *merrilli*, was on its breeding ground.

After reviewing Oberholser's account, as also the series of specimens of the races cited by him in his comparisons, we are not convinced that the existence of a recognizable race "in the region of the Sierra Nevada" has been established. Variations involving great extension of yellow posteriorly below, and in the other respects pointed to by Oberholser, are observable by us in *merrilli, actia, strigata* and *insularis*. We are inclined to consider any variations toward smaller size and darker colors that are found to pertain to horned larks on the extreme western margin of the Great Basin, where it breaks off to the lower Pacific district levels, better designated as tendencies toward the conditions in the Pacific Coast races, intergrades perhaps, than as justifying the recognition of a separate interlying subspecies of extremely interrupted distribution such as Oberholser's proposal would demand.

Tachycineta thalassina lepida Mearns

Northern Violet-green Swallow

Found by us in summer at several localities in the section, all below 6500 feet altitude and westward from Eagle Lake. A single specimen obtained from Elliott's, 1000 feet. Other localities where this species was observed are: six miles north of Red Bluff, 350 feet (April 5, 1928, earliest in the section); Red Bluff, 300 feet; Coyote Creek, 270 feet, April 7, 1928; Cone's, 270 feet; Dale's, 600 feet; Manton, 2300 feet; Battle Creek Meadows, 4800 feet; Turner Mountain at 6300 feet; north end of Eagle Lake, 5200 feet (June 18, 1928).

One example, male, April 14, weighed 13 grams.

In the blue oak covered hills six miles north of Red Bluff several small groups of this swallow were flying northward, close above the tops of the oaks. Other flocks were seen flying in the same way over the prairie near Coyote Creek; date as above.

On April 16, 1928, at Cone's a strong southeast wind was blowing all day. Many groups of ten to fifteen swallows, or the same group many times, were observed flying low over the fields. All when seen were flying toward the southeast, directly into the strong wind.

At Elliott's, on April 14, 1928, twenty-five or more individuals were observed in flight about a cliff and the trees, chiefly blue oaks, around the base of the cliff. Some of the birds lit in the trees and others hovered before openings to cavities in the trees. Apparently, this locality was being prospected, in preparation for nesting, by this group of birds.

Fully a dozen violet-green swallows were observed in flight, July 3, 1925, about the top of Turner Mountain. The birds were within a glacial cirque, often swooping low over the snow banks there. There was much twittering, and it was thought there were young in the flock.

Iridoprocne bicolor (Vieillot)

Tree Swallow

Occurs widely in the section, in summer, from the lowest altitudes up to 6100 feet. Collected at: Bloody Island, 350 feet; Dale's, 600 feet; Willow Lake, 5600 feet. Observed also at the following additional localities: Red Bluff, 300 feet; Cone's, 270 feet; Mill Creek, 260 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Manzanita Lake, 6000 feet; Wilson Lake, 5100 feet; Snag Lake, 6100 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; Jones', 5400 feet.

Two males collected in late May in the western part of the section weighed 17.4 and 18.9 grams. A fully fledged juvenal female from Willow Lake in July weighed 13.3 grams.

This species wherever found in the section usually fed over water or over ground that was at least marshy. Nesting birds were practically always limited to use of woodpecker holes in those trees that stood adjacent to bodies of water such as lake, river, slough, creek, and meadow stream. Often the stubs used were surrounded by water.

This swallow was seen in the western part of the section as early as April 6 (in 1928). On April 24, 1928, many groups were flying about the tops of tall dead cottonwoods at the edges of streams at Cone's. The used woodpecker nest holes in these trees were all high.

On May 14, 1924, some miles down the Sacramento River from Red Bluff, it was noted that the tree swallow was the most insistent vocalist among all the birds to be heard at early dawn and late dusk. In the morning at faintest dawn these swallows kept flying about in erratic course high over the river and tree tops, saying over and over again: *tsewick, tsewick, seep; tsewick, tsewick, tsewick, seep; tsewick, seep.* As a person lies in his sleeping bag he can follow the flight courses of the birds, still themselves indistinguishable in the darkness, by these notes, of marked rhythm and monotony. The holes in the dead cottonwoods and sycamores at the river's edge, then already "owned" by pairs of tree swallows, were judged to be by their diameters those made in previous years by Nuttall or willow downy woodpeckers.

On May 18, 1927, ten tree swallows were counted in sight at once, coursing over the water of Wilson Lake. On May 24, five pairs were found established in old woodpecker holes in aspens close to the eastern shore of this lake. One that was dug out as yet contained no eggs, but it was well lined with feathers, some of Canada goose. All the nests seemed to be in course of construction only. Their height above the ground varied from one to four meters. The birds kept coming to and entering the nests with persons standing close about.

On Battle Creek Meadows, June 1, 1927, a pair of swallows was noisily prospecting around several old holes of the hairy woodpecker in some aspens.

On June 7, 1926, a pair was watched carrying materials to a nest in one of a group of dead stubs in the water of Manzanita Lake. The nest hole was six meters above the water. This same set of stubs was occupied by the swallows when the lake was visited on June 17, 1927.

Then, heads of the birds were seen sticking out of several old woodpecker holes.

On June 13, 1929, several tree swallows were seen in the stub-forest near Spalding's. One occupied nesting hole was seen seven meters up in a yellow pine stub. First the female perched at the entrance, facing outward and preening. Then it went into the cavity. After a few minutes the male came and entered the nest hole and immediately the female flew out. Soon the head of the male appeared and remained at the entrance until the female returned. Seemingly, one bird stayed at the nest while the other foraged for insects for the young. There was little variation in this procedure for nearly an hour while the birds were watched.

Young-of-the-year were seen flying about over an open part of Battle Creek Meadows on July 2, 1925. At Jones', July 24, 1928, several, probably both adults and young, were flying over the shallow lake there.

Stelgidopteryx ruficollis serripennis (Audubon)

Northern Rough winged Swallow

A summer visitant at both the eastern and western ends of the section. Specimens collected at Blue Tent Creek, 300 feet, April 7, 1928, and at Red Rock P. O., 5300 feet, July 22, 1928. Also observed at: Red Bluff, 300 feet; near Tehama, 250 feet; Petes Valley, 4500 feet; Secret Valley, 4500 feet; Jones', 5400 feet.

A male from Red Rock P. O., July, weighed 17.3 grams.

This swallow was observed usually in flight close to water, over a river, lake, or marsh. For perches, wire fences, and telephone wires were sometimes used.

On the Sacramento River some miles above Tehama, May 14, 1924, in an earth bank above the river and six meters high were found three nest holes evidently made originally by kingfishers. In two of these holes, close to a meter below the brink of the bank and two meters apart, were nests of the rough-winged swallow. One was 36 centimeters back in a hole, with orifice 10 centimeters high by 13 wide. From without, a flooring of short coarse sticks could be seen, and this sort of flooring extended clear back to the nest. The saucer-shaped concavity of the nest was 60 millimeters across by 12 deep. The lining was of flat yellowed willow leaves on a scanty coil of black horsehair, and this on a loose foundation of slender sticks, grass stems and shredded bark about 30 millimeters deep. There were six fresh eggs plus the remains of another that had been broken. The birds, once in a while, came up near, over the water, and uttered their sputtery notes, *pssrt, pssrt.*

The other nest was located similarly to the first and contained five fresh eggs. The nest was coarser than the other, lacking horsehair. The material included drift sticks up to 4 millimeters in diameter and 80 long; there was a dead grapevine twig 130 by 3 millimeters. Other materials were flakes of dry horse manure, straws, and roots.

Near Jones', July 24, 1928, birds of this species were seen along a dry, artificial ditch with vertical walls containing holes suitable for nesting.

Sheldon (1907, p. 190) records the "bank swallow" as "uncommon" at Eagle Lake, the inference being that this species was present there at one time or another during the time of his visit in the summer of 1905, but in lesser numbers than the other kinds of swallows also recorded. Mr. Sheldon now thinks, he writes us (letter of July 13, 1929), that these birds were likely rough-winged swallows.

Hirundo rustica erythrogaster Boddaert

American Barn Swallow

Represented in the section by a few summer visitant pairs in the western and eastern ends. Specimens were obtained at Coyote Creek, 270 feet, and at Jones', 5400 feet. Observed also at: Ravendale, 5300 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet; Box Springs, 5300 feet.

An adult female from Jones', July 25, weighed 14.5 grams.

On July 10, 1928, at least two pairs were flying about the highway bridge across Coyote Creek, south of Red Bluff. Two recently hatched young and a nest were taken from one of the cement supports just beneath the bridge floor. This nest was made chiefly of pellets of reddish clay, probably from the near-by stream bed. The pellets had not been packed tightly together, but conspicuous air spaces had been left between them. A considerable amount of stems of weeds and grasses had been used as reinforcement material, especially toward the top of the structure. The cup of the nest itself was lined with feathers from a hen-yard and a few horsehairs.

Young barn swallows nearly ready to leave the nest were seen at Box Springs on July 8, 1925.

At Secret Valley ranch, on July 3, 1925, four young swallows just out of a nest were watched being fed by their parents. The young were perched on a bare limb on the shady side of a cottonwood tree. The approach of the adults with food caused the young to twitter and flap their wings. When feeding the young, the adults did not alight. A parent would hover for a moment in front of the young birds which would at the same time reach out and take the food from the bill of the parent. One of the fledglings would fly out and take the insects from the parents in mid-air (Dixon, MS).

In 1905, Sheldon (1907, p. 190) records, barn swallows were breeding at Eagle Lake.

Petrochelidon albifrons albifrons (Rafinesque)

Northern Cliff Swallow

A summer visitant to the section regularly westward from Turner's, 3500 feet altitude, and also in the far eastern end. Collected at Red Bluff, 300 feet. Observed in the following additional localities: six miles northeast of Red Bluff, 350 feet (April 5, 1928, earliest recorded in section); Antelope Creek, 300 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Manton, 2300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet (once, June 25, 1924); Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet.

In 1905, Sheldon (1907, p. 190) found cliff swallows breeding at Eagle Lake.

A male from Red Bluff, May 13, weighed 19.2 grams.

Loose companies of this swallow were seen usually in flight somewhere in the near vicinity of their nesting colonies. When feeding, the birds flew about over such places as rivers, ponds, marshes, fields, and orchards; they chose just those places, within their general range, where the largest numbers of flying insects might be expected to occur.

At six miles northeast of Red Bluff, on April 5, 1928, a flock of close to fifty cliff swallows was flying in a compact group over the edge of the river bank (fig. 80). On the undercut banks of sandstone at this point were outlines (beginnings?) of several nests, but it was not determined whether they were the work of that year or of some previous season.

On April 27, 1928, flocks of cliff swallows were seen flying over the meadow at Turner's. In the early morning several individuals were seen to fly, in turn, to the gables of a house and to cling there just beneath the roof, twittering, for a few minutes. Others flew about and even inside some barns on the ranch. There they were seen clinging to the sides of rafters. On the morning of April 30, two pairs had nests well started on the gables of the house. Each bird of a pair carried material and stayed on the nest base, shaping it, until the arrival of its mate. Then the first bird would leave immediately. While each nest was being watched one or the other bird was working at it practically all of the time. Each bird would fly off toward the meadow for new material.

Fifty-eight cliff swallows' nests were counted on the rafters beneath the roof of a barn at Elliott's on June 5, 1924. On the ground below were egg shells and two dead young, three-fourths grown.

A colony of cliff swallows was nesting, in 1929, inside and beneath the roof of a barn at Secret Valley Ranch. On June 16, adults were feeding young in the nests. Foraging was done chiefly out over the meadow and creek valley.

On July 22, 1928, at a group of deserted ranch buildings one mile east of Red Rock P. O., many cliff swallows were flying into and out of one partly open building, six meters square. Attached to the rafters, near the apex, were forty-one retort-shaped nests that were complete and which seemed to be in use or, at least, had been, that season. Nests were placed on either face of a rafter, apparently without discrimination. Most of the nests contained feathered and well grown young. The young birds crawled to the nest entrances to take the food offered by returning parents. On the ground beneath the nests were the broken eggshells and also accumulations of excreta that had been voided by the young while the adults were away food-gathering. Apparently, this was the only building of the group used for nesting that season; but the marks of nests showed that some of the others had been used in previous seasons. About one mile away from this colony another occupied colony was observed, made up of at least fifteen nesting pairs. The nests here were fastened to the faces of large rocks in a cañon wall.

The facts just given seem to indicate that in this section the cliff swallows in the eastern Great Basin portion nest nearly one month later than those birds which live in the western, Sacramento Valley portion. Probably a sufficient supply of food for young becomes available earlier in the western part of the section.

There appear to be in the section a much larger number of suitable nesting sites for cliff swallows than are occupied each year. The fact that colonies such as the one near Red Rock P. O. use different buildings in different years supports this idea. It looks also as though the kind and amount of food available would support a larger population of this species than actually lives in the section. Neither of the above-mentioned factors is, then, in this case, important in keeping the population down to its present small number. Some other factor, possibly an ectoparasite (one is known to infest this species, sometimes with serious results), must be important in checking the increase in this swallow. Also the latter factor may lead to alternation in the use of nesting sites in successive years.

Progne subis subis (Linnaeus)

Northern Purple Martin

Found by us only along the Sacramento River and at Bogard R. S., 5500 feet. Specimens were obtained near Tehama, and the species was observed also at Red Bluff and Silva's.

Weights, in grams, of three males collected May 14, were 53.6, 54.4, and 56.2 grams. A female of same date weighed 54.2 grams.

Martins were seen frequently in May in flight overhead at various points along the Sacramento River. At Silva's on April 13, 1928, several pairs were flying high over backwater among the tops of dead sycamores and cottonwoods at the side of a slough. A colony was found, May 14, 1924, to be nesting in old woodpecker-made holes in dead stubs of a large living sycamore tree near the river one mile above Tehama.

Townsend (1887, p. 221) records finding "a colony of a dozen or more martins . . . . established in a large dead pine on the edge of the forest at the eastern base of Mount Lassen on June 6," 1884. The only reachable nest "occupied a large decayed cavity 20 feet from the ground. It contained four fresh eggs. There were other nests higher up."

Several pairs of martins were seen in flight, June 22, 1929, over the meadow at Bogard R. S. Many dead trees were available for nesting. It was not determined which ones were being occupied.

In the summer of 1905, Sheldon (1907, p. 190) had reason to consider martins "fairly common" at the southwest end of Eagle Lake. Specimens of juveniles and adults were obtained.

Cyanocitta stelleri frontalis (Ridgway)

Blue-fronted Steller Jay

A regular resident in the coniferous forests of the section; occasional pairs occur westward in summer along stream courses as far as Elliott's. In winter much of the western part of the section is regularly visited by individuals of this jay. Specimens represent the following localities: Dale's, 600 feet, December 20, 23, and 25, 1924; Payne Creek P. O., 1600 feet, December 22, 1927 (observed, also, April 22, 1928); Lyman's, 3300 feet, June 11, 1924; near Mineral at 5200 feet, May 31, 1927 (observed also in December); Spalding's, 5200 feet, October

16 and 21, 1923; five miles north of Fredonyer Peak, 5700 feet, October 4, 1924. Observed at following additional localities: Tuscan Springs, 1200 feet, April 22, 1911; Elliott's, 1000 feet, December 25, 1927, and April 14, 1928; top of Inskip Hill at 3000 feet, December; Turner Mountain at 6300 feet, July; Broke-off Mountain at 8000 feet; Manzanita Lake, 6000 feet, June; Summit Creek, 5200 feet, June; two miles west of Black Butte, 6800 feet, June and July; Lake Helen, 8200 feet; Drakesbad, 5500 feet, September; Kelly's, 5200 feet, September; Prospect Peak at 7000 feet, June; Butte Lake, 6100 feet, June; Eagle Lake Resort, 5200 feet, June.

Three males collected in December weighed 106.5, 120, and 121.4 grams; one in October weighed 106 grams. A female obtained in December weighed 110.8 grams. Two taken in October weighed 120 and 123 grams. Two females collected, May 31 and June 11, weighed 100 and 106 grams, respectively.

Steller jays in summer were found in and about clumps of closely growing small coniferous trees, often as forming dense thickets of undergrowth in old forest that is thinning out, or at edges of forests. Kinds of trees that formed such suitable clumps and which were frequented by the jays were white fir, red fir, yellow pine, and hemlock. At the western frontier, the occasional pairs seen were usually in tracts of small yellow pines. The birds were seen most often at heights of close to four meters above the ground.

At other seasons than summer these jays were less closely restricted to any one particular type of woods. Also, in winter they seemed to spend more time upon the ground than at other seasons; possibly it was necessary to forage there more then to get sufficient food. Individuals were often seen working over fallen leaves. The tendency to move down the mountains in winter, to localities of little or no snow, was doubtless connected closely with this problem of forage.

Among the species that showed concern over the close presence of blue-fronted jays, the following were definitely noted: spotted towhee, western tanager, long-tailed chat, and ruby-crowned kinglet. In no case in our Lassen experience was any cause for disturbance discernible to the observer, other than the mere presence of the jay.

The tendency for birds of this species to show curiosity was illustrated by an experience on April 28, 1928, in the neighborhood of Turner's. There, when a collector was attempting to call small birds into view by making squeaking sounds, at least ten jays came together at one time from scattered territories in the surrounding woods. Since at this time the birds were spaced out for nesting, this was thought to be a rather densely populated area; for the birds thus congregated must have been within the hearing range of one another, with certain limitations.

A nest of the blue-fronted Steller jay was found near Turner's on April 27, 1928. The structure was one and one-half meters above the ground in a young yellow pine. This small tree was one of a close-growing thicket among larger trees whose trunks were less than one-fourth meter in thickness. A part of the base of the nest was made up of mud. Above that were coarser sticks, with a lining of many pine needles. When approached closely, the bird on the nest flew off and called a few times from a near-by perch. In the nest was one egg, evidently the first of a set.

In the same vicinity a jay was carrying nesting material on April 28. The nest was seen five meters up in a Douglas fir at the edge of a clearing at a stream source.

On June 7, 1926, two separate family groups, including young birds just out of nests, were seen near Manzanita Lake. Tail feathers of the young had not yet grown out. Each group was in a clump of fir trees surrounded by chaparral.

Bob-tailed young out of the nest were seen, June 24, 1929, in a small yellow pine at the edge of Butte Lake.

Examination of the series of nine *Cyanocitta stelleri* taken in the Lassen section discloses in it no conspicuous tendency toward either the race *carbonacea* or the race *annectens;* it is practically identical with series of corresponding dates from the central Sierra Nevada (Placer and Mariposa counties) and hence clearly referable to *frontalis.*

The gray jay (*Perisoreus obscurus griseus*) has been recorded in many publications as occurring on Lassen Peak. Search of the literature shows that these records are all traceable back to the following statement by Feilner (1865, p. 427): "This bird [*Perisoreus canadensis* he calls it] I first saw in 1859, in small numbers, when on an Indian scout, about Lossen's butte, hovering noiselessly about the road, catching flies by darting from one tree or bush to another. . . . ." As far as we have been able to find out, no specimen was procured; and the indication from this statement is that some entirely different bird might have figured. In lack of confirmation by Townsend or by any more recent ornithological observer in the region, we are forced to discredit this record and, of course, all the subsequent "records" based upon it.

Aphelocoma californica immanis Grinnell

Interior California Jay

Present in both ends of the section: in the west, all of the many records, for all seasons, below 3500 feet; in the east, from the vicinity of Eagle Lake to end of section, and with our records all for spring, summer and autumn (fig. 92). Specimens obtained from the following localities: Red Bluff, 300 feet; Bloody Island, 350 feet; Dale's, 600 feet; Inskip Hill at 1800 feet; Manton, 2300 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet; eight miles southwest of Ravendale, 5600 feet; Termo, 5300 feet; Dransfield's, 5300 feet; Jones', 5400 feet; Box Springs, 5300 feet. Also observed at following additional stations: Blue Tent Creek, 300 feet; Cone's, 270 feet; Mill Creek, 260 feet; Turner's, 3500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; north end of Eagle Lake, 5200 feet.

Henshaw (1879, p. 308) describes "a fledgling taken at Eagle Lake," in July, 1877.

Weights of four males collected in the western part of the section in December were 80, 102.7, 102.8, and 104.9 grams. Males collected there in May weighed 91.5, 99, and 101.6 grams. May and June taken females from the western part of the section weighed 74.5, 83, 83.3, and 86 grams. Weights in grams of males taken in October in the eastern end of the section were 71, 81, 92.1, and 92.4. An adult male and female from Box Springs, July 5, weighed 90 and 86 grams, respectively. Weights in grams of three October-taken females from the eastern part of the section were 61, 61.5, and 93, the latter an old adult.

This species, belonging to the brush-covered portions of the section, found suitable surroundings on the western slope of the section where the following kinds of plants grew: buck-brush, scrub oak, elderberry, hazel brush, manzanita, red-bud, grapevine. (See fig. 31.) Individuals were also often seen in trees, but, as a rule, in their lower portions. The kinds of trees thus frequented were: blue oak, willow, living or fire-killed digger pine, knob-cone pine, cottonwood, valley oak, sycamore, box elder, and orchard trees. In the eastern part of the section the jays frequented the slopes that were juniper covered. In addition to the junipers they were seen in mountain mahogany, sage-brush, and willows (in the cañons).

In December, 1927, on the southern slope of Inskip Hill the jays were most numerous in the tall scrub oak chaparral. Many individuals in flight were seen there, carrying acorns; but no acorns were seen on the trees. One individual was scratching among black oak leaves on the ground along with golden-crowned sparrows and spotted towhees.

When observations were made in a densely growing grove of valley oaks at Silva's, on April 13, 1928, many California jays were present; as many as six or eight were within sight or hearing all through the day. The birds were in the thickets and in the tops of tall, living or dead, sycamores or oaks. Several individuals watched as they foraged, spent as much or more time on the ground as in the trees. They foraged on the more open spaces at the edges of the woods. One bird clung to the bark close to the ground on the main trunk of a large oak, to pick at some object of food value. One that moved through the crown of a large tree over a course of several meters, instead of flying or hopping from limb to limb, moved along on the tops of, and close to, some larger limbs. At that time the birds were especially noisy and they called almost constantly, accompanied by frequent "bobbing."

Near Dale's on May 22, 1924, a California jay was seen closely pursuing a rock wren low over the ground, zigzagging about two meters behind it until lost to view behind bushes.

A nest was found, April 13, 1928, in the crown of an elderberry bush growing on the flood plain of the Sacramento River near Silva's. The nest was well shaded in the lower part of the crown of the shrub and three and one-half meters above the ground. An adult was sitting on four eggs in the nest. When a sound was made beneath the nest the bird left quietly. A box elder and a large cottonwood were standing close to the site of this nest.

At Cone's a nest was found, April 16, 1928, two and one-half meters from the ground in a dead tree over which a vine was growing. The clump was on the open side of a border of trees and brush along a stream. The nest was loosely built and many sticks were dangling from it. The sitting adult slipped quietly off the nest when the observer stood directly below it. The nest contained only one egg.

Another nest of this species was found near Manton on April 20. This nest was three-fourths of a meter above the ground in a hazel bush growing in pasture land. Some stems of poison oak were also growing through the bush. On the surrounding slope and growing in clumps were buck-brush, manzanita, and red-bud. The ground on all sides was open and grassy and the clumps of bushes were scattered. The base of the rather compact nest was made of sticks with a few dry grass stems. The deep cup presented a black appearance, being lined entirely with black horsehair. The nest contained four eggs. One adult was on the nest at noon and another was in close-by shrubbery.

Several family groups of young were seen, around the end of May, 1926, near Manton. In 1928, several family groups were noted on

July 17 and 18, on a hill slope eight miles southwest of Ravendale. The behavior and appearance of these young birds pointed to the conclusion that nesting in this species must be several weeks later in the eastern than in the western part of the section.

In our Lassen section series of *Aphelocoma* we are unable to detect differences between west-end and east-end birds; all fall within the race characters for *immanis*.

Pica pica hudsonia (Sabine)

American Black-billed Magpie

Found in the section from the vicinity of Eagle Lake eastward (fig. 111). Specimens obtained at Merrillville, 5000 feet; five miles north of Fredonyer Peak, 5700 feet; and in Petes Valley, 4500 feet. Recorded by observation: around Eagle Lake at Spalding's, 5200 feet, one trapped but not saved, October 14, 1923; also along the southeast shore of the same lake; near Horse Lake at 5500 feet; Secret Valley, 4500 feet; Dransfield's, 5300 feet, January 3 to 7, 1926; Jones', 5400 feet.

An adult male obtained October 4, weighed 186.7 grams. An immature male shot July 13, weighed 163.2 grams.

The black-billed magpies that were seen in the section were in groves of mountain mahogany, among extra large *Purshia* bushes, in lone juniper trees, or in clumps of willow. A recently occupied nest was seen, June 21, 1921, in a mountain mahogany on the east shore of Eagle Lake and near where pelicans had nested. Many shells of pelicans' eggs were found on the ground about this nest. A family of young was being fed by parents in near-by trees. Many old nests were seen in dead junipers along the north shore of Eagle Lake in June, 1928. In a cañon up which the road leads to the southwestward out of Horse Lake valley on June 19, 1928, nests were seen on a north-facing hillside situated in the very large bushes of *Purshia tridentata* that grew there; a group of noisy old and young birds was scattered about on the hillside near-by. In Petes Valley old nests were seen in cottonwoods and in juniper trees.

On June 8, 1929, a family of young just out of a nest was seen with two adults in small junipers at the western edge of Petes Valley. Several others were seen on the tops of sage-bushes on the floor of the valley. At one place four young were flushed from the ground amid a dense growth of sage-brush. At another place a nest three meters up in a dense-topped juniper was thought to contain young. The parents circled at a distance, much concerned.

Of all the localities where this species was observed in the eastern part of the section Secret Valley was the most densely populated. There the birds lived numerously in the clumps of willows bordering the stream.

Pica nuttallii (Audubon)

Yellow-billed Magpie

A resident at the lowest levels within the section, mostly very close to the Sacramento River and its larger tributaries (fig. 111). Specimens collected at Cone's, 270 feet. Also observed at or near: Red Bluff, 300 feet; Silva's, 270 feet; Jelley's Ferry, 325 feet; Bloody Island, 350 feet; Tehama, 250 feet.

A male and female collected December 29, 1927, weighed 188.1 and 162.7 grams, respectively.

This magpie was to be seen frequently as we traversed the more thickly settled portions of the Sacramento River valley. There, it was noted, most often in small scattering groups, in the following kinds of places: On rocks at the edge of the river; on the ground in roads, or on fences at roadsides; in scattered blue oaks at the edge of the valley; in valley oaks; in tall cottonwoods and sycamores bordering stream courses; in pastures; in plowed fields (fig. 81); in orchards; about stockyards and barns.

Groups of magpies along roadsides appeared to be indifferent to automobiles passing by, but as soon as a machine would be stopped near some of the birds, they would all immediately get out of shotgun range. In 1911 several specimens were obtained by taking advantage of this indifference on the part of the magpies to moving vehicles. By using a horse-drawn carriage it was possible to approach the birds to within easy shotgun range, an almost hopeless undertaking for a person on foot (L. Kellogg, MS).

All the individuals that were observed did their foraging for food on the ground. Often the birds were seen digging with their bills in loose, cultivated soil. The bill of a bird shot was caked with heavy mud. They regularly kept off in the fields during the day; in the neighborhood of Cone's, they congregated about the ranch buildings late in the afternoon.

In 1884 the species was "very common," probably quite as now, around Red Bluff, to judge from the comments of Townsend (1887, p. 211). The birds, then as now, were "always to be found about the buildings on the ranches, ... and their brush-pile nests were conspicuous objects in the scraggy oak trees near them."

Occupied nests of magpies were observed along Antelope Creek near Cone's on April 6 and 16, 1928. One pair centered its interest in a nest twenty-five meters above the ground in the top of a dead cottonwood at the edge of the stream. The birds were seen to visit this nest several times during the day, but whether or not they carried material there could not be made out. Many other birds of this and other species (among them crow, sparrow hawk, and California jay) were close by, but no sign of enmity or even of interest on the part of any in the presence of the others could be detected. A magpie was seen, once, on April 16, to carry a stick to this nest. On that date trips to the nest were made more frequently than was the case on April 6. The birds did not stay at the nest each trip for long. The young were large enough on the 16th to be heard from the ground when they were being fed.

Another nest, 100 meters from the one described above, was ten meters above the ground in the center of the crown of a leafless sycamore (fig. 46). Apparently, adults were feeding young in that nest too. Both these nests, and others that were seen, were in situations practically inaccessible from the ground.

Complaints from ranchers that these birds were annoying were practically identical in 1911 and 1928. Our work at certain localities, especially at Cone's, indicated that in 1928 there were fully as many individuals, if not more, than had been present seventeen years previously. This, too, was in a neighborhood where farms were continually being made smaller and where the human population was increasing. Also we were assured that the birds were killed whenever there was opportunity. In this region magpies appear quite capable of holding their own.

We have closely scrutinized our series of eight specimens of *Pica nuttallii* from within the western end of the section, these examples thus being from very nearly the northernmost point in the known general range of the form. We are unable to detect the slightest differences, as compared with *nuttallii* from Santa Clara, Monterey, and San Luis Obispo counties, in either general dimensions, size of bill, or color of bill. In other words, there is no evidence of any intergradation at the north with *Pica pica hudsonia*. The two forms are constantly distinct, even though populations of the two exist at this latitude only eighty miles from one another.

Corvus corax sinuatus Wagler

Western Raven

A male (no. 41553) was collected, October 7, 1915, at or near Red Bluff by Mr. C. S. Mueller. Individuals were observed by us in the vicinity of Red Bluff on the following dates: May 7 and 27, 1924; June 11 and July 6, 1925; December 30, 1927 (near Tuscan Buttes, ten miles east of Red Bluff). In the eastern part of the section ravens were found at Termo, 5300 feet, October 12, 1924; Dransfield's 5300 feet, January 2 to 7, 1926, and October 16, 1924; Red Rock P. O., 5300 feet, July 23 and 24, 1928. Not more than three individuals were in sight at any one time, save for one flock of nine that was seen (by A. E. Borell) in October at Dransfield's.

In 1883 and 1884, Townsend (1887, p. 212) saw ravens only in the vicinity of Red Bluff, and there on only "one or two occasions."

Corvus brachyrhynchos hesperis Ridgway

Western American Crow

Present in summer locally in western part of section below 600 feet altitude; one winter record. Noted in fall once at Eagle Lake. Specimens collected at Red Bluff, 300 feet. Stations where observed are as follows: ten miles north of Red Bluff, 500 feet; Silva's, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Tehama, 250 feet, December 28, 1927; Mill Creek, 260 feet; Dale's, 600 feet; Spalding's, October 22, 1923 (flock of sixteen).

A brooding female, collected at Red Bluff, May 4, weighed 404.5 grams.

A review of the kinds of situations where crows were observed indicates, for this region, a choice for a fairly fixed type of habitat. First, this bird requires trees for holding its nest out of reach of ground-prowling enemies. The nest trees must be of such a size and arrangement of branches as to furnish a firm foundation for the (relatively to the tree) bulky nest.

Then the crow, compared with other passerine birds, is of large size. The species is adapted to use as food many sorts of plant and animal matter. In order to obtain a sufficient amount for their nourishment, of food of these generalized types, crows have to forage on the surface of the ground and cover large areas of it. It is our impression that no other type of feeding situation in the section would furnish in sufficient numbers the proper food objects except ground surface.

The above two requirements in combination would restrict the residence of crows in the section to those places where suitable nesting trees are available and where the birds might have access to food-producing open ground. Situations of this nature are found in the near vicinity of streams in the Sacramento Valley portion of the section and at a few other places. Judged on the basis of these requirements the most favorable area for crows would appear to be the small prairie-like openings in the blue-oak covered hills ten miles north of Red Bluff (fig. 54). It was, indeed, in that vicinity that the nesting population of crows was more crowded than in any other part of the section.

At Cone's on April 6, 1928, a nest was being built by a pair of crows in the main crotch of a dead valley oak, with only the two main trunks left standing, at the side of a stream. The stump was covered with a grapevine, at that time leafless. The crotch was ten meters above the ground. Apparently, only one bird worked at the nest, although its mate was always close by, even when the two were in the air. The working bird broke sticks from dead branches in the tops of nearby trees and carried them to the nest. The work went on steadily all day, with slightly reduced activity in the early afternoon. After each trip to the nest the birds usually "rested" in some near-by dead tree. Certain movements of the tail while the birds perched were taken to indicate a high degree of excitement. Close approach by other crows usually resulted in all taking to the air, but no actual encounters were seen. Crows were seen in and about this tree when visited again on April 24.

On April 7, 1928, at Coyote Creek, crows were seen flying over, and perching in, the scattered cottonwood trees bordering that creek. An old nest was seen, and another possibly of recent construction.

On April 9, 1928, crows were numerous on the prairie ten miles north of Red Bluff and among the oaks on the surrounding hills. At that date they were in pairs, usually, although one group was seen, foraging on the ground, which contained fifteen individuals. On the tree-covered hills many old nests were seen and one was under construction five meters up in a small blue oak. This nest was nearly completed, a part of the lining being in place. The base was made of sticks. Strips of bark, apparently from cottonwoods, made up the coarse lining. Inside that were several clumps of sheep's wool; and in the bottom of the cup, not yet arranged, were some bunches of fresh, green moss.

In the vicinity of Cone's, in April, 1929, there seemed to be many more crows than had been present at the same place the previous year. Also at the later season there seemed to be a considerably greater area of tall-vegetation-free ground over which the birds could forage; at least there was more area of the type on which they did forage. (See fig. 81.)

On the morning of April 17, 1929, two crows were seen near the highway south of Red Bluff, that were pulling olives from trees and eating them. There were no suitable nesting trees in the immediate vicinity of that place.

Townsend (1887, p. 212) says of crows that, in 1884, they "were breeding everywhere in the timber belts south of Red Bluff." Early in May, "their nests always contained four eggs. . . . . "

A nest on which a female (collected) was brooding, was found May 3, 1924, close to the Sacramento River near Red Bluff. The site was at the forking of bare, oblique branches, ten meters up in a sycamore tree. On the tree-covered hills north of Red Bluff a nest from which a bird flushed was found, May 8, 1924, eight meters up in a blue oak. Two nestlings were taken from a nest in a valley oak near Red Bluff on May 13, 1924.

On Mill Creek, June 10, 1912, a nest was seen eight meters above the earth in a willow on ground away from the stream and then dry. The young crows were evidently about to leave their home, for two were perched on the structure and one was in another part of the tree.

Cyanocephalus cyanocephalus (Wied)

Piñon Jay

On May 24, 1925, three piñon jays were seen in the dead timber at the margin of Eagle Lake near Gallatin's, 5200 feet. At that station a first-year male (no. 44407) was collected, October 14, 1923. On October 4, 1915, a first-year female (no. 41567) was collected by Mr. C. S. Mueller at Merrillville. A large flock of piñon jays was seen in the scattering junipers on the divide between Eagle Lake and Grasshopper Valley on June 18, 1928.

Nucifraga columbiana (Wilson)

Clark Nutcracker

Found in the section at the higher stations from the western slope of Broke-off Mountain at 7500 feet east to the vicinity of Fredonyer Peak. Collected at following stations: Broke-off Mountain at 7500 feet; Manzanita Lake, 6000 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet; Shumway, 5100 feet, September 16, 1916. Also observed at the following additional localities: two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Lassen Peak at 10,400 feet; Warner Creek at 8000 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Prospect Peak, 8340 feet; Bogard R. S., 5500 feet; Feather Lake, 5500 feet; Eagle Lake Resort, 5200 feet; Pappoose Valley, 5200 feet.

An adult male from Spalding's, October 19, weighed 151.7 grams. A young male from Butte Lake in June weighed 134 grams. An adult female taken in June at Butte Lake weighed 130 grams. An adult female, shot six miles northeast of Mineral, June 30, weighed 134 grams.

The Clark nutcracker was most often observed in flight high over coniferous forest. Sometimes one or two would be seen perched in the top of some tall pine or fir tree. At the margins of some of the lakes, tall stubs of water-killed trees furnished suitable perches that were used.

On July 13, 1924, four nutcrackers were met with in one part of the crater in the top of Lassen Peak (Borell, MS).

Near timberline on Lassen Peak (fig. 10), 9500 feet, on August 1, 1925, six nutcrackers were observed that were quiet and which appeared to be intent upon catching for food the grasshoppers which were plentiful on the gravelly places between boulders. Near Spalding's, October 19, 1923, several birds were seen that were thought to be harvesting—carrying off and storing—seeds of yellow pine. One that was shot had thirty-four pine seeds in its mouth and throat.

At Butte Lake, several nutcrackers were seen on the afternoon of June 29, 1928, foraging solitarily on the lava blocks (fig. 77) at the water's edge, possibly finding aquatic insects to their liking there.

Families of young that had been out of the nest, apparently, for several weeks, were seen in early June, 1926, near Butte Lake.

An individual perched near the top of a tall tree near Manzanita Lake on June 27, 1929, flew into the air after an insect and returned to the same perch.

Of now historical interest in regard to this species is the statement of Newberry (1857, p. 83) that he "first met with it [the last of July, 1855] in the spur of the Sierra Nevada, near Lassen's butte . . . . ," which he crossed through "Noble's Pass."

Penthestes gambeli abbreviatus Grinnell

Short-tailed Mountain Chickadee

Resident in a large part of the section eastward from the 3300-foot contour line. Found occasionally in winter at low altitudes on the western slope. Specimens were obtained at the following places: Dale's, 600 feet, December 22 and 24, 1924; eleven miles east of Payne Creek P. O., 3500 feet, December 31, 1924; Lyman's, 3300 feet; Mineral, 4900 feet; toward Broke-off Mountain at 6500 feet; Manzanita Lake, 6000 feet; Warner Creek at 8000 feet; Willow Lake, 5600 feet; five miles north of Fredonyer Peak, 5700 feet; eight miles southwest of Ravendale, 5600 feet; Termo, 5300 feet; four miles northeast of Red Rock P. O., 5400 feet. Observed but not collected at: summit of Inskip Hill, 3000 feet, December 26, 1927; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Summit Creek, 5200 feet; Morgan Hot Springs, 5000 feet, December 21, 1927; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; slope of Lassen Peak proper, at 9000 feet, May 17, 1924; Wilson Lake, 5100 feet; Drakesbad, 5500 feet; Kelly's, 5200 feet; Prospect Peak, 8340 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Feather Lake, 5500 feet; Slate Creek, 5700 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet.

Weights of three females from the western part of the section in December were 9.4, 11.2, and 11.8 grams. Two males, December and May, from near Mineral, weighed 9.8 and 12 grams, respectively. Three males and a female from the central part of the section, June, weighed 10.5, 14.3, 16.4, and 10.8 grams, respectively; a young female, nearly fully plumaged, 13 grams. Three males and a female from the eastern part of the section, July, weighed 10.9, 11.6, 11.9, and 10.8 grams. An immature male, Warner Creek, September 10, weighed 9 grams. Two adult males from the eastern part of the section, October, weighed 11.1 and 16.1 grams.

In the higher portions of the section chickadees were observed to frequent lodgepole pines, white firs, hemlocks, yellow pines, and junipers. At lower altitudes, in winter, the birds were observed also in blue oaks and valley oaks. Wherever found, this bird foraged about the ends of branches and over twigs in the outer parts of the foliage of the trees. Apparently the more open portions of the woods, or their marginal portions, were most favorable for the species.

On December 20, 1927, at 6400 feet on the trail from Mineral to Broke-off Mountain, the only birds detected during nearly an hour were two chickadees that went down to drink at an opening through the snow, in a little stream beneath the alders in a ravine. The ground everywhere about was then covered with about 18 inches of snow.

During the winter chickadees regularly made up portions of the companies of birds of several species that foraged together through the day. Some of the individuals that moved to low altitudes in winter joined circulating bands of bush-tits.

Two chickadees were observed building a nest near Mineral on May 15, 1927. The cavity was in the side of a rotting stump, sawed off flat on top many years previously, about one meter high; the entrance, a cleft in the rotting wood thirty-eight centimeters above the surface of the mound about the base of the stump. The nest cavity was only twenty-three centimeters above the surface of the mound. The material accumulated up to that time was rabbit fur. The stump was in an open space, once logged off, where small firs and lodgepole pines were now growing.

On subsequent visits to this site no birds were seen until on June 3, when one was brooding closely. When a slab of rotten wood was removed the bird lunged, at the same time spreading its wings convulsively, and then gave a prolonged hissing sound—just that order of procedure. The bird repeated this performance nineteen times by count before it suddenly flew from the nest at the close approach and light touch of the observer's hand. The body had been kept closely depressed into the nest cavity. The lunges were rather inane—the bird simply struck out, in one direction and then another. At the moment of the lunge, the black-and-white striping of the head brought her into abrupt and conspicuous view of the observer peering into the cavity—reinforcing the surprise effect of the sounds produced. At times, the hissing sound was produced, the wall of the cavity was struck, and the white of the head moved, all at the same instant. When the bird left, the observer could see no eggs at all; the movements had resulted in the fluffy rabbit-fur completely covering the eggs. While the five fresh eggs were being removed from the nest the two birds of the pair were about at some little distance calling with concern (Grinnell, MS).

Near Mineral on June 1, 1927, an occupied chickadee's abode was found slightly over one meter above the ground in a hole in an aspen. One bird was seen to bring a moth into the hole, but whether to its mate or to young was not ascertained.

Near Manzanita Lake, June 6, 1926, an adult was found brooding on a nest in a burned stump one and one-half meters high and surrounded by closely growing chaparral. The cavity was on the south side of the stump and was close to one meter above the ground. In this nest were four recently hatched young and two unhatched eggs.

Three nests were found in the neighborhood of Butte Lake. One, slightly over a meter from the ground, was in a dead stump close to a meter in diameter. Two chickadees were seen, June 13, 1926, close by, one of which entered the nest hole. When the stump was tapped the bird refused to leave, but it made the hissing sound, accompanied by flapping wings, described above. Another nest was at about this same height above the ground in a hole in a small living aspen. Two adults were feeding young in the nest on June 16. The young birds could be heard calling whenever a parent entered the cavity with food. The third nest also contained a brood which the parents were feeding on June 27, 1928. This one was close to two and one-half meters up, in an old stub at the edge of the water.

Close to Mineral on June 16, 1925, a chickadee's nest, with young, was discovered in a woodpecker hole opening on the under side of a leaning stub, one-third meter in diameter and five meters long. The entrance was 1.7 meters above the ground. Diameter of the entrance was 44 millimeters, so it was thought probable that it was made by a white-headed woodpecker. The site of the stump was open, surrounded by a dry, snow-brush-covered slope. Some very small yellow pines stood close by, as also two yellow pine stumps sawed off so long ago that they were rotted and cleft. The old birds brought food freely, even though an observer was seated only five meters away. Each bird dived directly into the hole as it arrived, without loitering at the threshold. But as it emerged it looked about for a moment before flying away. Usually when leaving, an adult carried a pellet of excrement in its bill, taking it to a distance, beyond the observer's range of sight. At times, both old birds were in the nest hole together. No notes could be heard from the young birds when they were being fed. Such food as could be seen brought consisted of green caterpillars. By the morning of June 20 these young birds had left their nest, and were scattered about in the snow-brush, even though they were rather feeble of flight. One that was pursued hid itself effectually down within the tangle.

The parents remained in the vicinity through the summer and the fully grown young were seen about. On July 15, in the morning, a chickadee was again carrying food to the old stub. The stub was tapped a few times, and a moment later an adult flew out carrying an excrement sac. The nest was watched for half an hour and record made of the feedings. One or the other parent was seen to enter the cavity with food eleven times; in detail as follows:

8:59, out at once,
9:03, out at once,
9:07, out at once,
9:08, out at once,
9:10, stayed 30 seconds,
9:11, stayed 7 minutes,
9:18, both parents out, one with excrement,
9:21, out at once,
9:22, out at once,
9:25½, out with excrement,
9:29½.

At times one parent would pause an instant on a small tree near the nest; but at the entrance itself the birds did not hesitate at all, popping in and out so fast it was usually impossible to identify the food carried (H. W. Grinnell, MS). Both the adults served in keeping the nest clean, as was observed on July 20 when one followed the other closely in leaving the nest cavity, each carrying an excrement sac. At mid-day on July 28, the young birds were restless, calling a great deal, fluttering their wings, and one or two sticking their heads through the opening almost constantly. It was easy to distinguish them, now fully fledged, from the adults, by the yellow showing plainly at the base of the bill in the young. Both adults were bringing food at short intervals, although at that time of day most other birds were quiet and inactive. By the next day this, the second brood reared in the same nest, and probably by the same parents, in one season, had left the stub.

On June 15, 1928, close to Eagle Lake Resort, two old chickadees were observed taking food to a hole, only eighty centimeters above the ground, in a dead stub on the lake shore. On the next morning the nest was chopped into and seven young were found, half-grown but cold and dead. The skulls of some of the nestlings had been cut into, as though by some small rodent.

Five half-grown nestlings were found in a burnt stub at the edge of Battle Creek Meadows on July 8, 1925. The nest entrance was 1.6 meters above the ground. The cavity was apparently a naturally rotted out one inside a vertical split, twenty-five millimeters across at the widest place. The birds were still in the nest on July 16, but they were gone when the site was visited on July 19.

A nest, not one of those described above, was found at Mineral, 195 centimeters above the ground, and another at Summit Creek close to five meters up. However, most of the occupied cavities were under two meters from the ground, the lowest being the one thirty-eight centimeters up.

Judging from the accounts given above, the breeding season of this species in the section must extend over three months, from early in May to late in July. During this period, at least some pairs rear two broods. The size of the brood, at hatching time, ranges usually from five to seven.

On July 18, 1928, at eight miles southwest of Ravendale, among junipers, thirteen chickadees were seen between 6 and 9 in the morning. The birds were in pairs and small groups, each group probably representing a family.

In the stub-forest near Eagle Lake Resort two chickadees were observed feeding young in a nest on June 11, 1929. The cavity was two-thirds of a meter above the ground in a stub over fifty meters high. At first both parents were near, but one withdrew back into the nearby woods when the observer approached. The remaining bird, with food in its bill, then perched in a tree six meters from the nest. From there it made eight or more sorties toward the nest cavity but nearly every time it turned back in mid-air. Once or twice the bird lit for an instant at the edge of the cavity. Finally it mustered enough courage to go into the hole and deliver its food. The nest hole was partly the result of natural decay and partly the work of some wood excavator (woodpecker). It had evidently never been a woodpecker's nest.

On the next day another nest was seen in this same vicinity; one and one-half meters up in an old woodpecker's nest hole in a yellow pine stub. The matted nest was within 15 cm. below the entrance. At first both the parents were seen in a small pine. One bird was quivering its wings and calling softly. The other, with its bill full of food, was giving over and over the harsh notes of the usual sort for the species. The first bird went to the nest and stayed for several minutes. The second one continued calling. When the one in the nest left, the other went in and came out without the food. It was thought that the young were very small since only faint notes could be heard from the cavity.

Another nest found June 12 was 165 mm. (to lower rim) above the ground in a large yellow pine stub. The opening was 30 mm. in horizontal diameter by 40 mm. in vertical diameter. Both parents were carrying food into the cavity. The stub stood on the edge of the belt next to the forest where most of the foraging for food was done. Some of the insects were caught in late afternoon by pursuing them into the air. Young yellow pines that were growing close by shaded the entrance.

Near Bogard R. S. on June 21, 1929, a chickadee was gathering food material from the lower trunks of lodgepole pines and from the ground, and was carrying it to a cavity close to thirteen meters up in a tall, dead trunk of a lodgepole pine. Once the bird brought out and dropped to the ground a piece of the dark, finely woven nest material.

Two adults were feeding young, June 28, 1929, in a cavity two meters up in the top of a stump of lodgepole pine at the edge of Sugar

Pine Flat, northwest of Mineral. The stump was in the shade of a clump of pines. The same day, at the lower edge of Battle Creek Meadows, a nest of young was being fed in a cavity below a crack in the top of a stub of lodgepole pine two meters high.

"Late in June, 1884 [Townsend, 1887, p. 228], a nest was discovered in the pine forest at the western base of Mount Lassen. It occupied a crack in the end of a prostrate pine log by the roadside, and contained young birds nearly grown." Townsend says this species bred at that time on the slopes of Lassen Peak, "even up to the highest timberline," this being quite in accord with our own present-day findings.

In the series of eighteen skins preserved, all are referable to the race *abbreviatus,* save one (no. 45673, ♂), from five miles north of Fredonyer Peak, taken October 8, 1924. This bird is distinctly browner than the rest; the flanks and sides are rather strongly tinged with cinnamon and the dorsum is wood brown—in contrast with the much grayer tones of ordinary *abbreviatus.* This feature of the coloration recalls the condition in the Rocky Mountain *P. g. gambeli;* but the wing and tail are short, 67.2 and 57.5 millimeters, respectively. The combination of features just indicated suggests the assignment of this specimen to the northern subspecies, *P. g. grinnelli,* named from Idaho by van Rossem (1928, p. 104). In support of such course of action, the date of capture is consistent with the possibility that the bird was a transient or autumnal vagrant from rather far to the northward. However, with just the one example in hand, and lacking evidence that this species of chickadee is so extensively migratory, we refrain, for the time being, from formally recording it under the separate name.

Baeolophus inornatus inornatus (Gambel)

California Plain Titmouse

Resident on the western slope of the section as high as 3500 feet altitude (fig. 99). Specimens were collected at: Blue Tent Creek, 350 feet; Red Bluff, 300 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; eight miles east of Payne Creek P. O., 2800 feet; eleven miles east of Payne Creek P. O., 3500 feet. In addition, observed at: ten miles north of Red Bluff, 500 feet; Silva's, 270 feet; Cone's, 270 feet; Elliott's, 1000 feet; top of Inskip Hill, 3000 feet; Manton, 2300 feet.

Weights of four males in December averaged 16.9 (15.5 to 18.4) grams. Six females, December, weighed from 15 to 17.2 (average 16.2) grams. Weights of four May-collected males were 14.4 (a juvenal), 15.4, 16, and 17.3 grams. Weights of four May-taken females (one adult and three full-grown young) were 13.2, 12.6, 14.4, and 19.2 grams, respectively.

A considerable variety of larger plant species furnished situations favorable for some major activity of this bird species. The trees and shrubs that were definitely recorded as foraged through by the plain titmouse are the following: willow, cottonwood, sycamore, valley oak, live oak, black oak, blue oak, golden oak, several species of orchard trees, digger pine, and buck-brush. We are left with the impression that the blue oak (fig. 72) is the tree within the Lassen section used for feeding place, nesting, and shelter by the largest number of these birds.

A feeding titmouse observed, May 30, near Dale's, picked off a green leaf from a live oak and carried it to a twig. There the bird held the leaf down with one foot and picked at it with the bill. Then that leaf was discarded and the whole performance was repeated with another leaf. The discarded leaves, upon examination, showed that each had had an insect pupa attached to it (Borell, MS).

On August 4, 1925, a day when the heat seemed intense, plain tits were observed near Dale's to seek shade in the creek bottom and, there, to hold their bills widely open, panting.

Except during a part of the summer when some of the adults were brooding, or when families of young were still with their parents, this bird was normally observed in pairs, the two individuals keeping rather close to one another. Sometimes in winter, a pair joined in with loose aggregations of foraging birds of other species.

In an orchard close to Manton a nest was discovered, April 17, 1928, in an almond tree. The nest was in a natural cavity below a knothole in the main trunk of the tree and two and one-half meters above the ground. The site was found by watching a titmouse carry food to it, probably to the brooding mate. The observer was close to this tree several times within the three days following, but no bird was seen near it. Finally, on April 20 when the cavity was examined with the aid of a reflected light, a sitting bird crouched on the nest; but it could not be induced to leave even by pounding on the tree. A part of one egg was seen projecting beyond the bird's feathers (Linsdale, MS).

Full-grown young of this species were observed as early as May 9, 1924, in the vicinity of Red Bluff.

Townsend (1887, p. 228) records finding "a nest containing seven eggs . . . . in a poultry-house at Red Bluff," April 4, 1884. The nest "occupied a cavity between the joists, quite near the roosting place of the chickens. The sitting female made no effort to escape" and was gently lifted from the nest.

Baeolophus inornatus griseus (Ridgway)

Gray Plain Titmouse

Found in the eastern, Great Basin portion of the section (fig. 99), where specimens were obtained at: eight miles southwest of Ravendale, 5600 feet; near Termo, 5300 feet; Jones', 5400 feet.

Weights of three adult males, taken in July, were 17, 17.7 and 18.3 grams; of two full-grown juvenal males, 15, 18.5. One adult female, July, weighed 16.2, and two juvenal females, same month, 16.2, and 18.3 grams. Seven October-taken males averaged 21.3 (17.5 to 23.1) grams in weight. Five females, October, averaged 17.1 (15.2 to 22.2).

Practically all the birds of this species that were found were in or among fairly close growing, large juniper trees (fig. 59) such as covered most of the ridges and slopes in the section eastward from the neighborhood of Eagle Lake. Sometimes one would be seen in a sage-bush between trees, but the amount of time spent by the birds in such low growths was small.

On June 19, 1929, a nest of this species was found eight miles southwest of Ravendale. Two adults were feeding young in a cavity below a knot-hole in a juniper and two and one-half meters above the ground. The birds were exceptionally nervous when a person stood near the nest tree. They called loudly and one of them quivered its wings rapidly. The calls of the young could be heard plainly from the ground. Both adults were carrying food to the nest when it was visited the next day. On three occasions an adult was seen to carry off an excreta sac. The bird would feed the young and then come to the nest entrance and look back; then it would return to the cavity and leave directly, carrying the sac for as great a distance as 100 meters.

Psaltriparus minimus californicus Ridgway

California Bush-tit

Resident at the western end of the section, from the floor of the Sacramento Valley up to about the 3500-foot level, occurring higher in summer, possibly by up-mountain invasion. Present also, at least by mid-June, in the eastern end of the section, from the north end of Eagle Lake eastward as far, at least, as our station eight miles southwest of Ravendale. (See fig. 100.) Whether the birds seemingly of this race nest there, or whether they remain there through the winter, is not positively known. Specimens represent the following localities: Blue Tent Creek, 350 feet; Cone's, 270 feet; Mill Creek, 260 feet; Dale's, 600 feet; Inskip Hill at 1800 feet; Manton, 2300 feet; north end of Eagle Lake, 5200 feet (June 17 and 18); eight miles southwest of Ravendale, 5600 feet (July). Observed at the following additional places: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Silva's, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Elliott's, 1000 feet; Payne Creek P. O., 1600 feet; Turner's, 3500 feet (April 26); Manzanita Lake, 6000 feet (June 5 and 6).

Weights of three December-taken males from the western part of the section were 5.2, 5.2, and 5.4 grams; two females, 5.5 and 5.7. An adult and two juvenal males in May weighed 5.4, 5.6, and 6.6 grams, respectively. A juvenal female in May weighed 6.1 grams.

Bush-tits foraged over nearly the same territory in winter as in summer. Within the section the presence of bushes and small trees with broad-leaved, evergreen foliage where the winter flocks might find sufficiently productive forage routes appeared an important factor in the presence of the species. In summer the birds seemed to forage over all sorts of medium height vegetation.

Records of this species, a band of ten and a single bird, at Manzanita Lake, June 5 and 6, 1926, may have represented birds which moved up the western slope of the mountains for more productive forage grounds after the breeding season.

Sometimes in winter, birds of other small species joined the moving flocks of bush-tits. For example, mountain chickadees and golden-crowned kinglets were found in different flocks of this species in December.

On April 5, 1928, a bush-tit's nest was found on one of the hills six miles north of Red Bluff. The nest was close to four meters above the ground in the top of a live oak. The top of the nest was flat and compact and was fastened securely to some limbs. The lower part of the nest was attached loosely to twigs at one side by a few strings. Just below the top of the nest and on the north side was the evenly circular entrance. The site was completely shaded. From the ground this nest appeared to be made up of about equal parts of moss and sheep's wool. Wool probably was picked from sticks close to the ground. Moss may have been gotten from moist rocks in the creek on whose bank the nest tree stood. At frequent intervals parents were adding materials to the nest, or, possibly, feeding young birds in it. Most of the foraging was done in the tops of live oaks which stood near by.

Another nest in that vicinity was seen on April 8. This one, also four meters above the ground, was in a lower limb of one of a clump of large live oak sprouts. Poison oak grew thickly around the base of the tree clump. While the nest was well shaded, it was visible plainly from below. Wool appeared to compose most of the nest as it was viewed from the ground. An anxious pair of adults called in the near vicinity. Contents of the nest were not determined.

Nest-building activity of a pair of bush-tits was watched, April 11, 1928, near Antelope Creek where that stream enters the plain of the Sacramento River. This nest was five meters above the ground in a small branch (stem 4 centimeters in diameter) of a large cottonwood. The site was one-half meter from the main trunk of the tree which was two-thirds of a meter in diameter at that height. Both birds of the pair were working at the nest in the afternoon. The two arrived together: one entered the nest and immediately came out; the other went in and stayed for several minutes, while the first remained near. At 2:22 both birds left together and returned at 2:27, whereupon one went in and immediately out, while the other entered and worked for two minutes. Then followed several trips at approximately one-minute intervals. Later, at 2:55, one bird entered the nest. A few seconds after that the mate arrived and after one minute went into the nest with material. Immediately one bird came out, while the other remained. Possibly this time the female arrived first and, of course, did not wait for the male. The general working plan for this pair seemed to be as follows, with variations: both birds went out and gathered material and returned, together. One, probably the male, went in and left its material, then went out. The other bird (female?) then entered and worked into the nest the material which both had brought. Arrival of the birds was announced by a continuous giving of notes by both birds. Frequent stops were made on the way to the nest, and always each bird looked around just before it entered the cavity. This nest was a dark gray color, nearly matching that of the bark on the main trunk of the cottonwood in which it was placed (Linsdale, MS).

At Silva's on April 13, 1928, a bush-tit was seen gathering nest material from high in a dead tree. It pulled cottony-looking cobwebs from the side of the trunk and carried them away.

On the next day a nest was found at Elliott's. This one was hanging in a tangle of vines of grape and clematis, growing over a spindling, and not yet leafed out, oak in a creek bottom. The nest was exposed so as to be seen easily from the ground. Both birds of the pair made trips to the nest. It was thought that the nest contained young.

Two birds were starting a nest at Manton on April 18. The site was two and one-half meters above the ground in a clump of manzanita. A pendant band of material between two supporting twigs hung as low as the birds could reach when perched on one of these twigs.

Evidently, the nest comes to have its final shape as a result of all the motions of the bird's body inside tending to stretch the lower portion downward and outward, rather than from being built from a framework having at the outset the characteristic nest-shape. The two birds were making frequent trips with material to the nest.

On April 18, 1929, a nest was seen in the hills seven miles northeast of Red Bluff. The structure was two meters above the ground in the drooping end of a live-oak branch. Both parents were carrying food to the seven young in the nest. The young birds were thought to be about five days old. The food brought appeared to be medium sized green caterpillars. The adults did not hesitate at the nest entrance when taking in food.

At Cone's on April 24, 1928, a pair of bush-tits was carrying material to a nest two meters from the ground in stems of a vine over a medium sized valley oak at the edge of a creek. Short limbs of the tree were given off as far down as the nest so that, situated as it was, it benefited by the screen and shade that they provided.

Family groups of bush-tits were seen out of the nest earliest at Dale's on May 21 and 22, 1924. At Mill Creek, by June 10, 1912, large flocks had been formed; 16 individuals were counted in two such flocks.

Toward the eastern end of the section, the bush-tits of the *californicus* type collected were found in junipers and mountain mahogany trees, as also in intervening bushes of sage-brush and other kinds. At the north end of Eagle Lake, June 17, 1928, a family of adults with full-grown young, at least 5 in number, was watched foraging through a mahogany. Southwest of Ravendale, July 18 and 19, 1928, three small groups of bush-tits were encountered (Lamb, MS), two of them in junipers and one of the companies in bushes. In each case, one of the individuals taken is identified on the basis of its average of characters as *californicus* rather than *plumbeus* (which see, p. 317).

Psaltriparus minimus plumbeus (Baird)

Lead-colored Bush-tit

Found in July at three stations in the Great Basin end of the section (fig. 100), namely, eight miles southwest of Ravendale, 5600 feet altitude, Secret Valley, 4500 feet, and four miles northeast of Red Rock P. O., at 5400 feet altitude. Only one example (no. 53197) was taken at the latter place, from the only flock seen there, July 25, 1928; it was in a juniper on the wall of a cañon. This is a full-grown young one in which the post-juvenal molt is just beginning, and in characters it is unequivocally *plumbeus*.

A family group of young with parents was seen moving through the tops of willows along the stream in Secret Valley, June 16, 1929. The tails of the young birds had not yet grown out. Once an adult was seen to feed a caterpillar to a young one. It was felt certain that this group must have come from a nest within a short distance of where the birds were seen. Another group of similar aged young birds was seen, June 19, in the junipers on a slope eight miles southwest of Ravendale.

At the more westerly station, southwest of Ravendale, nine bush-tits were obtained, out of four groups of up to twelve individuals each. These companies were in junipers and intervening bushes, and two, in one case three, of the birds were shot out of each company. In the field, the birds taken were thought to be all *plumbeus,* but when it came to making comparisons in the Museum, a confusing state of affairs presented itself. For three (nos. 53189–91) out of the nine specimens taken show an average of characters most like *californicus,* even though each was shot in company of at least one other bird quite certainly referable to *plumbeus!* The following table gives facts concerning this series of bush-tits.

Record of *Psaltriparus* Obtained Eight Miles Southwest of Ravendale

No.	Sex	Age	Date	Wing	Tail	Weight	Pileum	Dorsum
				mm	mm	gr		
53189	♀	Im.	July 18, 1928	46.6	51.3	6.0	Drab	Mouse gray
53190	?	Juv.	July 19, 1928	47.6	52.5	5.7	Hair brown	Mouse gray
53191	♂	Ad.	July 19, 1928	46.9	49.8	6.2	Drab	Mouse gray
53188	♂	Ad.	July 17, 1928	49.0	53.8	6.1	Between mouse gray and drab	Mouse gray
53192	?	Juv.	July 17, 1928	49.2	51.7	6.1	Mouse gray	Mouse gray
53193	♀	Juv.	July 18, 1928	47.8	52.9	5.2	Mouse gray	Mouse gray
53194	♂	Juv.	July 18, 1928	49.6	55.1	5.4	Light mouse gray	Mouse gray
53195	♀	Juv.	July 19, 1928	49.8	52.6	5.7	Mouse gray	Mouse gray
53196	♀	Juv.	July 19, 1928	49.3	52.1	6.1	Near deep mouse gray	Mouse gray

In this connection, reference must be made to the extended discussion of bush-tit characters and relationships, by Swarth (1914, pp. 499–526, pl. 40 [map]): It is to be observed that our series from the single locality presents somewhat the same sort of situation as

Swarth found to obtain to the southward, in Inyo County, California, where the forms *californicus* and *plumbeus* meet or at least closely approach one another. Thence Swarth records specimens of "*plumbeus*" showing tendencies in characters toward *californicus*, in company with "good" *californicus*. From the Warner Mountains, Modoc County, he records under the name "*californicus*" a specimen "strikingly similar" to certain specimens of *plumbeus*. On the basis of these equivocal specimens, Swarth considers the advisability of returning to the trinomial designation of *plumbeus*, making it one of the subspecies of *minimus*, along with *californicus*. He hesitates to do this, however, because of fewness of stations as well as of specimens representing possible intergradation. Furthermore, the few birds of critical significance did not indicate a gradual blending of characters, but rather, an unequal assortment, and they occurred on only an exceedingly narrow north-south line, as if they might have had a hybrid origin.

Since the time Swarth wrote, not only the same situation has been found to obtain in our Lassen section, but also, apparently, in Mono County (Grinnell and Storer, 1924, p. 582), and in Modoc County (Mailliard, 1927, p. 335).

To return to our own evidence: the nine bush-tits from southwest of Ravendale might conceivably represent a composite population consisting of (1) resident birds of true *plumbeus* mixed with vagrant individuals of *californicus*, wandering groups of which had moved from the westward in the same season after the young had reached full size; *or* (2) of resident birds of *californicus* characters, mixed with individuals of *plumbeus*, vagrant from an eastwardly direction; *or* (3) entirely of birds resident for long series of generations in exactly the neighborhood where found, but of more or less remote ancestry in the two phylogenetic directions, of *plumbeus* and *californicus*.

Considerations which seem to throw out (1) and (2), are earliness in the season (mid-July) that the juvenals of "*californicus*" and "*plumbeus*," both, were taken. Then, we do not know that, normally, bush-tits undertake any such post-breeding journeys as would be necessary for the theory that the two racial types had bred in separate ranges; also no economic reason is apparent for such extensive vagrancy in this territory, as there is in the case of up-mountain, post-breeding movements of bush-tits in southern California. And finally, both racial types were taken in the same flocks, though it must be recalled here that such flocks are often composed of two or more families.

There remains as the most plausible explanation, that we have here a sample of a closely inter-related population derived from two forms (*californicus* and *plumbeus*) in an area of contact. This is further shown by the intermediacy in some respects or in others, of several of our specimens, as shown in the table. While three of them exhibit characters strongly of *californicus*, these characters are not shown to the degree that specimens of *californicus* from the Sacramento Valley end of the section show them. In other words, our Ravendale "*californicus*" are somewhat intermediate toward *plumbeus*. On the other hand, no. 53188, an adult, which is otherwise *plumbeus*-like, exhibits a brownish tone on the pileum—a tendency toward *californicus*. And this also is the situation that was found by Mailliard (*loc. cit.*) in Modoc County. The last five examples in our table are indistinguishable from Nevadan *plumbeus*, and they are all juvenals.

To sum up, adding all the evidence gathered since Swarth's review of the question to that which he presented, we are now inclined to consider intergradation between *californicus* and *plumbeus* as established and at more than one place, in just the right geographic positions to demonstrate subspecific rather than full specific status: Both forms, then, are subspecies of the species *Psaltriparus minimus*, wide-ranging, quite as once held, from Texas to the Pacific.

As to the application of names to the individuals comprising the Ravendale series, difference of opinion has arisen between the two of the present authors who had the problem to work out. One of us (Linsdale) thinks that, if this population be resident and intimately inter-related, one name, and that one *plumbeus*, should be employed for the entire series. On the other hand, one of us (Grinnell) sees justification for assorting the members of the series under the two names, the first three in the table under *californicus* because of their strong resemblance to that race as exemplified farther west, the balance of the series under *plumbeus*.

An inconsistency in this latter handling of the case will doubtless at once be seen; that is, in the listing of probably near blood-related individuals—possibly, indeed, of common immediate parentage—under two systematic designations. The senior author admits this, but points to the seeming irregular behavior of the characters, *suggesting* segregation in offspring (though not at all proving this in the genetic sense), by which, instead of the smooth blending ordinarily observed in "geographic variation," some of the individuals, although intergrades in one sense, are rather definitely, in features presented, on one side or the other of a mid-line between the two forms (*californicus* and *plumbeus*), as their characters are developed to the westward and eastward, respectively. In an area of exceedingly narrow width between two strongly marked subspecies, where actual meeting of populations has been only intermittent, when interbreeding does recur, then the population of resulting intergrades (hybrids, perhaps, in one sense) are likely to exhibit the characters of the two subspecies in mosaic fashion. While the whole population may, it is granted, be looked upon as intermediate, individuals are met with of character-combinations outstandingly of one or of the other type. Thus, the three specimens given first in our table may be listed under the name *californicus*, the last six under *plumbeus*—upon the assumption that, on the average, appearances reflect degree and direction of relationship. Someone else might prefer to call all the bush-tits in the variable series in question simply *Psaltriparus minimus*—and he could advance reasonable ground for his preference!

An obvious comment may be offered in conclusion, that the eastern end of the Lassen section offers, in the bush-tits there, an attractive field for investigation of the family and racial behavior of two incompletely separated races.

Sitta carolinensis aculeata Cassin

Slender-billed White-breasted Nuthatch

Resident in the section widely, from the Sacramento Valley proper eastward to about the 3500-foot contour (fig. 101). Collected at the following localities: Blue Tent Creek, 350 feet; Red Bluff, 300 feet; Cone's, 270 feet; Mill Creek, 260 feet; Dale's, 600 feet; top of Inskip Hill, 3000 feet; Payne Creek P. O., 1600 feet; eleven miles east of Payne Creek P. O., 3500 feet. Also observed at the following places: ten miles north of Red Bluff, 500 feet; Silva's, 270 feet; Bloody Island, 350 feet; Elliott's, 1000 feet.

Weights of eight males collected in the western end of the section in December averaged 18.2 (17.7 to 19.1) grams. Three females, December, weighed 17.6, 17.7, and 17.8 grams. Four May-taken males, an adult and three young, weighed 16.5, 17.5, 17.6, and 20.7 grams, respectively. A female, May, weighed 20.5 grams.

This race of white-breasted nuthatch had its metropolis entirely within the "blue" vegetational area, in the western end of the section; that is, the birds collected and found upon comparison to belong properly to the subspecies *aculeata* were all from points west of the western edge of the "green" coniferous timber. The trees they most frequented were blue oak, valley oak, digger pine, and, along stream courses, cottonwood.

At a point six miles north of Red Bluff on April 8, 1928, a white-breasted nuthatch's nest was found in a cavity five meters above the ground in a broken lower limb of a living blue oak. The tree stood near the bottom of a small ravine. The nest opening was on top of, and at the end of, a limb which extended nearly horizontally from the main trunk for at least three meters. The site was found by tracing the course of the male as it carried food to the female at the nest. The male foraged chiefly between 150 and 200 meters from the nest. Trips were made at irregular intervals of ten or more minutes between 9:30 and 11:30 A.M.

When approaching the nest this male would give several single call-notes. After his arrival at the entrance the female would give low chirps and would come to get the food. Once the female came into view outside the cavity. The male approached the nest over different routes, sometimes alighting in the top of the tree and sometimes flying directly to the nest cavity. Once, it carried the insect away; possibly the female did not come out. After the observer started to climb the tree the female slipped out of the cavity, looked around, and left without making a sound.

On April 15 the male was still carrying food to its mate on this nest. When the site was again visited on April 23, the young had hatched and both parents were carrying food to them. When the nest was first approached, one parent bird remained outside the cavity and called constantly for several minutes. Then the mate came with insects and went directly to the nest, fed the young, and carried away a fecal sac. Finally, the first bird went into the nest and came out, flying off, as nearly as could be discerned, with its bill empty.

A second nest was found, April 9, 1928, this one, ten and one-half miles north of Red Bluff. The nest was in a natural cavity below a knot hole two meters above the ground on the east side of a large, partly living blue oak. The male was carrying food to the brooding female, making trips at intervals of close to one minute. Sometimes the bird flew directly to the nest cavity and sometimes it lit higher in the tree and scrambled down over the trunk to the entrance. The diameter of the cavity was close to fifty millimeters. Its depth was around twenty-five centimeters. The female, when poked with a twig, would not leave the nest; but just before the male reached the nest on the next trip the brooding bird flew out hurriedly. As nearly as could be determined, the nest was composed of feathers. A portion of the tail of a Douglas ground squirrel was visible in the cavity. Six eggs could be seen; possibly there were others concealed by the feathers. After an interval of five minutes the female returned to the nest, but two or three advances and retreats were made before the bird finally entered the cavity to resume incubation. The male was never seen to enter the nest cavity.

At Silva's, on April 13, 1928, a male was watched that came twice to a large valley oak at the edge of the woods where it foraged over the trunk and limbs, even going out onto the ground and picking up insects. These the bird took off into the woods in the direction of its nest which later was found by tracing the course of the bird. This nest was in a cavity below a crack in a large limb of a valley oak, and it was at least fifteen meters above the ground. The male did not enter the nest cavity but it called and waited until the mate, uttering the usual chattering call, came to the entrance (Linsdale, MS).

Young, out of the nest, were seen as early as May 9 (1924, near Red Bluff).

Sitta carolinensis nelsoni Mearns

Rocky Mountain White-breasted Nuthatch

Resident in the higher coniferous forests of the section westwardly from Eagle Lake to about Battle Creek Meadows (fig. 101). Specimens collected from: Mineral, 4900 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet; Eagle Lake Resort, 5200 feet. Observed also (presumably this race) at additional localities as follows: Manzanita Lake, 6000 feet; Lake Helen, 8200 feet; Wilson Lake, 5100 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Prospect Peak up to 7800 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet.

An adult male and a full-grown young female from two miles west of Black Butte, July 7, weighed 18.2 and 17.5 grams, respectively. A male, Warner Creek, September 27, weighed 20 grams.

This race of white-breasted nuthatch was observed in the following trees: yellow pine, white fir, lodgepole pine. On the west side of Eagle Lake, on May 21, 1925, a nest was found in a water-killed pine stub on the lake shore. A bird was bringing food to the site. Near Manzanita Lake, June 11, 1926, a bird was seen to leave a hole in a stump and drop something as it flew away, as if carrying feces from a nest of young. At Butte Lake, June 27, 1928, a nuthatch came regularly to forage in the trees at the water's edge, the results being carried each time back up the slope through the woods. A family group was encountered near Black Butte, July 7, 1924, from which a full-grown juvenal was shot.

Two white-breasted nuthatches were watched as they foraged in the stub-forest near Eagle Lake Resort on June 12, 1929. Much of each bird's time was spent in flying into the air and catching flying insects.

On June 12, 1929, a nest was found in the stub-forest near Eagle Lake Resort. It was one and one-half meters up in an old woodpecker nest hole on the southeast side of a stump three meters high. The close-woven, felted nest was within ten centimeters of the entrance. Both parents were carrying food to young at 8:45 A.M. and at intervals sometimes as short as one minute. The young, four of which could be seen, were nearly fully feathered. The cries of the young when adults brought food could be heard plainly to a distance of fifty meters. Once an adult was seen to carry off an excreta sac and drop it in flight, thirty meters off. Foraging for food was done back in the living yellow pine woods.

When it came to studying the series of white-breasted nuthatches from the Lassen section we became convinced that subspecific separation was necessary, by which the specimens from the higher and eastern portion of the range of the species would be grouped under a name apart from *aculeata.* The characters of the birds from places from Mineral eastward consisted in longer and stouter bill, longer wing, browner flanks in females, grayer flanks in males, deeper slaty tone of dorsum, blacker top of head in females, and greater amount of white subterminally on lateral rectrices. All these characters are just those that pertain to the race *nelsoni* of the Rocky Mountain region, although the degree of their manifestation is not, in some respects, quite so extreme as in *nelsoni* from Arizona, whence this subspecies was described. On the basis of the material before us, we see no alternative but to put our "green-forest" nuthatches under the name *nelsoni,* and in so doing bring the name into the California list for a representative of the *carolinensis* group of nuthatches occupying the extreme northeastern corner of the state.

Sitta canadensis Linnaeus

Red-breasted Nuthatch

Found as a resident generally distributed in the mountains of the section between Lyman's and Bogard R. S. The following localities are represented by specimens: Lyman's, 3300 feet; Mineral, 4900 feet; ridge northeast of Mineral, 6000 feet; Drakesbad, 5500 feet. Observed also at the following stations: Turner's, 3500 feet; Turner Mountain at 6000 feet; Battle Creek Meadows, 4800 feet; Morgan Hot Springs, 5000 feet (December 21, 1927); Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Prospect Peak at 7500 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet.

Sheldon (1907, p. 190) found this species at or near the southwest end of Eagle Lake in the summer of 1905.

A male collected in December weighed 9.9 grams. One in May weighed 11 grams. An adult female, June 8, weighed 11.5 grams. A young female, in full annual plumage, October 8, weighed 8.1 grams.

This nuthatch foraged over the limbs of coniferous trees. Three birds that were observed feeding over branches of lodgepole pines moved along the top surfaces of the limbs but also kept examining their sides and lower surfaces.

On May 9, 1927, a red-breasted nuthatch was found in course of excavating a nest hole. The bird flew from the nest site when the observer pounded on the lower part of the trunk, but it returned within a fraction of a minute to continue its series of digging movements. The stub was fir, very old and rotting, a little over half a meter in diameter and five meters in height. It stood in open ground on the site of a long abandoned sawmill, the ground round about being springy with deep layers of sawdust and rotting fragments of timbers. The site was one mile east of Mineral. The nearest trees, twenty-five meters off, were small yellow pines, lodgepole pines, and firs; larger trees, seventy-five meters off, were firs.

On the following morning, May 10, the observers waited twenty minutes or so around eight o'clock, only hearing the notes of the nuthatch at a distance. Again at 9:30 the notes were heard in the vicinity and the bird came within a few minutes. When the bird returned first an Audubon warbler had just alighted on the top of the stub. The nuthatch at once flew down from a near-by yellow pine and dashed at the warbler, putting the latter to flight; then it immediately began to work.

The nest hole was estimated to be four meters above the ground. It was on the southeast face of the smooth-surfaced, barkless trunk. There were a few short stubs of branches near the top of the stump, grown with tufts of yellow lichen. On one of these, one-fourth of a meter or so below and to the left of the hole, the bird at times alighted. When these first observations were made the hole was only about as deep as the length of the bird, leaving the tail plus the crissum protruding into view. In the morning sunshine the magnified shadow cast by the tail in its up and down movements accurately registered the blows dealt by the bill and head within the excavation.

The procedure of the bird during the excavation was somewhat as follows: in; four to eleven blows; out; pause, with quick sidewise turn or two of the head; in; etc., repeated with slight variations. On the morning of May 10 the bird was watched at work for two periods: 9:41¼ to 9:57½ and 10:5½ to 10:25. The numbers of "ins" made in three two-minute periods were 27, 22, and 27 (average 25). This makes 447 "ins" with the accompanying "outs" and "pauses-to-look" in the whole time of observation, 35¾ minutes. The taps by the bird inside the excavation also were counted, as registered by the twitching tail-shadow (often also accompanied by audible taps). The number of blows, based on twenty-five counts, ranged from 4 to 11 per "in" and averaged 7¾. This average would have resulted in a total of 3462 blows delivered within the hole during the two periods covering 35¾ minutes.

Further timings were taken, counting seconds spent "in," which averaged between four and five, thus checking closely with the time-rate gotten previously. Once in a while, when pausing "out" at the nest hole, the bird gave a *wă* note, once two times and once seven times, slowly. Autos passing twenty meters away did not appreciably interrupt or affect the regularity of the operation. Neither did the movements or talking of the observers seated fifteen meters away.

Occasionally as the bird emerged it flipped out small chips big enough to be seen. When leaving at the end of a period of work, the *wă* note was given two to seven times in a yellow pine near by. Once faint *clucks* were heard as the bird traversed the branches lengthwise rapidly, seemingly foraging.

On the morning of May 11 when the nest site was again visited the bird was working at the cavity. By this time the excavation was deep enough so that when the bird was working, no shadow was cast by its tail. On that morning as well as during all previous observations only one bird was seen about the site and this one was determined definitely to be the male.

As the bird backed out of the excavation it always paused and looked about, in a horizontal position, not vertically like a woodpecker. It would swing backwards to the left so that it clung to the orifice, facing to the right, with head swinging out and bill slanting up. Only rarely was the bird seen clinging to the rim of the hole in the opposite direction, that is, facing to the left, and then it promptly reversed itself at the next in-and-out (J. and H. W. Grinnell, MS).

Sitta pygmaea pygmaea Vigors

Northern Pigmy Nuthatch

Found by us as a resident at a few localities between 3500 feet and 6500 feet altitude in the mountainous part of the section. Specimens were obtained at Battle Creek Meadows, 4800 feet, and Mineral, 4900 feet. In addition the species was observed at: Turner's, 3500 feet; Manzanita Lake, 6000 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet.

Townsend (1887, p. 228, footnote by Ridgway on same page, and MS) evidently confused his nuthatches somewhat. He procured two specimens of *pygmaea*, as identified by Ridgway, somewhere "on" [that is, near] Lassen Peak, July 4, 1884, one an adult, the other a young bird.

A male taken from a flock of fifteen to twenty at Mineral, December 21, 1927, weighed 10 grams. A male and a female, collected June 1, weighed 10 grams each.

In general, this nuthatch was found to forage through the coniferous woods; in particular, individuals were observed in live yellow pines, lodgepole pines, and firs, and in dead, water-killed trees of undetermined kinds. A factor apparently of importance in determining at least the *local* habitats of pairs in summer was the presence of dead stubs, of wood of the right consistency for excavating holes for nests.

Near the western end of Battle Creek Meadows a nest-building pair of pigmy nuthatches was discovered on May 14, 1927. The birds had selected for a site a dead lodgepole pine stub four meters high and one-half meter through. In the stub were several old woodpecker's holes and two that appeared to belong to the nuthatches. The uppermost of these, two meters above the ground, was the one being worked upon in earnest.

On May 16 the site was visited again and observations were made on the work of excavation. After a wait of a few minutes a bird arrived (7:06 A.M.) at the lower hole and tapped a few times, but it quickly moved to the upper, main hole. There the bird posed motionless upside down, clinging to the upper rim, facing out, bill at right angles to back. At the end of forty-five seconds it *peep*-ed and at once proceeded to dig. The usual manner was for the bird to swing back and forth, the sequence as follows: in, several blows rapidly, out, look about, in, etc. Blows counted in a series of twenty-five "ins" ranged from two to eleven, averaging nearly six. After each series of blows the bird would swing outward and look about quickly with two or three turns of the head, then continue. The blows were counted by watching the movements of the hinder end of the body and of the tail. In one two-minute period the bird was "in" twenty-nine times. Many of the blows were so vigorous, the wood being of the right sort, as to be audible by the observers seated on a log twenty meters away.

Although two birds, evidently mated, were seen about the nest site, it appeared that all the work of excavation was done by one of them alone. The mate came to a branch of the stub and preened and *peep*-ed, but the worker kept on digging vigorously. The idle mate flew to a close-by tree and returned to within a fraction of a meter of the nest, but the worker, seemingly, paid no attention to it.

After nearly twenty minutes of excavating, the worker stopped and perched, absolutely quiet, for two minutes on a small branch of the stub. Then the mate arrived and the two birds flew off together.

On June 1 this site was again visited. The two birds were observed to go to the nest hole. An examination of the stub showed that the excavation had not yet been completed and that there was not sufficient room for a nest in it. The entrance was 27 millimeters wide by 35 millimeters high. The two birds, when shot and examined on that date, showed no sign of immediate egg-laying (J. and H. W. Grinnell, MS).

Near Manzanita Lake on June 5, 1926, a pigmy nuthatch that was observed for ten minutes tried ten or fifteen times to enter a small hole near the top of a lone pine stub standing on a chaparral-covered slope. A pair of mountain bluebirds that was nesting in that stub kept a close guard and drove off the smaller bird at its every approach. Once, a bluebird appeared actually to catch and hold the nuthatch by the back and to carry it down nearly to the ground (Linsdale, MS).

Contrasted with the situation just recounted is an experience with a pair of this species in the vicinity of Spalding's on June 17, 1928. There, in one dead stub was a nest of this nuthatch and, in addition, nests of three other species: house wren, western bluebird, and tree swallow. Their behavior indicated that all four pairs of birds were feeding young in this one stub at that time; and there was no hint of incompatibility.

A pigmy nuthatch observed June 16, 1926, near Butte Lake, entered a small hole close to six meters above the ground in a tall stub.

Among the numerous birds inhabiting the border of dead stubs along the lake shore close to Eagle Lake Resort, two pairs of this nuthatch were observed, June 16, 1928, carrying food to families of young in nests six and fifteen meters above the ground, in different stubs.

Near Eagle Lake Resort, on June 11, 1929, two adults were feeding young in a cavity one-third the way to the top of a stub thirty meters high which was standing at the edge of the lake. The foraging was done back in the living pines and firs. The birds carried away excreta sacs from the nest.

Certhia familiaris zelotes Osgood

Sierra Nevada Brown Creeper

Found in the section in summer from the 3300-foot contour line on the west to the vicinity of Eagle Lake. Present in winter on the western slope down to the lowest altitudes. The following localities are represented by specimens: seven miles east of Red Bluff, 750 feet; Dale's, 600 feet; Inskip Hill at 3000 feet; Mineral, 4900 feet, December 21, 1927; ridge two miles northeast of Mineral, 5500 feet, July 29, 1925, and December 20, 1927; Summit Creek, 5200 feet; Warner Creek at 6600 feet, September 28, 1923; Willow Lake, 5600 feet. Creepers were observed but not collected at the following additional places: Blue Tent Creek, 300 feet, January 1 and April 5, 1928; Cone's, 270 feet, December 29, 1927; Lyman's, 3300 feet, June 8 to 14, 1924; Battle Creek Meadows, 4800 feet; Broke-off Mountain at 8000 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Morgan Hot Springs, 4800 feet, December 21, 1927; Wilson Lake, 5100 feet, May 18, 1927; Drakesbad, 5500 feet, October 5, 1923; Kelly's, 5200 feet, September 2, 1925; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet.

Males weighed as follows: summer-collected adults, 6.7, 6.9, 7.1 grams; first-year male, September 28, 8.2; a December male, 7.4. Winter-taken females weighed: 6.3, 6.5, 7.9, 8.6, 9.1, 9.2 grams.

The range of situations through which the brown creeper feeds is indicated by the following list of trees, on the trunks or limbs of which individuals were observed: valley oak, live oak, blue oak, digger pine, yellow pine, white fir, incense cedar, lodgepole pine. Deciduous trees predominate within the winter range of the creeper, while coniferous trees predominate in the territory occupied in summer. The parts of the trees searched over for food were the trunks and larger limbs. Although seen usually in rather thick woods, creepers sometimes were found, as at seven miles east of Red Bluff on December 30, 1927, on the trunks of small, far-separated blue oaks.

In winter single creepers were sometimes seen moving along with flocks of feeding bush-tits and kinglets.

At 8000 feet on the western slope of Broke-off Mountain, June 17, 1925, a creeper's nest was found three meters above the ground and behind a curled-up section of thin bark on a dead lodgepole pine. The tree trunk was close to twenty-five centimeters in diameter. Mounds of snow were all about the tree, which was surrounded by hemlocks and red firs. An adult creeper came to the nest with its bill full of insects.

On a ridge one mile above Bogard R. S. two adults were seen, June 21, 1929, carrying food for young into a crack in loose bark on a large, dead yellow pine. The cavity was close to twenty meters above the ground. At nearly every visit the bird would alight a meter or so below the entrance and creep upward over the bark. Foraging was done over the trunks and limbs of the nearby large coniferous trees, both living and dead.

On June 26, 1925, a family numbering at least four young with tails not fully out was seen ten meters or so up on the trunk of a cedar near Mineral. The young birds were being fed by both parents.

Chamaea fasciata henshawi Ridgway

Pallid Wren tit

A resident at a few localities on the western slope of the section below 3300 feet altitude. Specimens were obtained from the following places: Inskip Hill, several places on southern slope above 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet. Observed also at ten miles north of Red Bluff, 500 feet.

Weights of nine males collected in December ranged from 14 to 17 (average 15.4) grams. A female in December weighed 13.8 grams. A male, juvenal, taken in June, weighed 17.9 grams. Three females, June, weighed 11.9, 14.7, and 15 grams.

Only a few restricted areas within the western part of the section presented conditions, seemingly, satisfactory for this species. The inhabited areas differed from the rest of the contiguous territory most conspicuously by being covered with tall, close-growing chaparral. The following kinds of plants that grew on the favored areas were frequented by wren-tits: scrub oak (fig. 42), golden oak, manzanita, and buck-brush. Of these the scrub oak in the form of clumps as it grew in this region seemed best fitted to the habitat needs of this bird.

Although pairs of wren-tits were most often seen at levels between one-half meter and two meters from the ground, they would occasionally go higher. For example, one individual was observed near Manton as high as eight meters from the ground in a digger pine, whence the trilled notes were given.

At ten miles north of Red Bluff, on April 10, 1928, several single birds were seen whose mates were probably, at that time, brooding eggs. Near Manton, from April 18 to 21, 1928, pairs of adults were seen which may then have had young in nests.

The series of fifteen skins of *Chamaea fasciata* from the western slope of the Lassen section presents about the extreme of color pallor as shown in specimens of the race *henshawi* from the western slope of the extreme southern Sierra Nevada.

Cinclus mexicanus unicolor Bonaparte

Northern American Dipper

A resident along mountain streams in the section from near Lyman's east to Warner Creek at 6600 feet. A single specimen was collected at 3000 feet on Antelope Creek, southwest of Lyman's. Observed at the following additional places: Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet, December 19, 1927; Martin Creek at 5100 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 6600 feet.

A full-fledged juvenal male, taken June 7, weighed 48.5 grams.

The dipper was limited closely to the swiftly flowing streams in the mountains. The birds almost invariably were seen over or in the water of a stream. The one exception to this apparent rule was noted on July 15, 1924, when, throughout the day, two birds were seen about Emerald Lake, near Lake Helen.

On June 22, 1924, a dipper's nest was found placed on a large beam, part of a wooden bridge across the main stream in Battle Creek Meadows. The nest was two meters above the water of the creek. Of the four eggs in the nest two contained embryos nearly ready to hatch. The other two were addled. Only one adult was observed here.

Troglodytes aëdon parkmanii Audubon

Western House Wren

Regularly present in the breeding season in the lower western end of the section and in the vicinity of Eagle Lake. Encountered in summer, not nesting, at many places in the mountains. Specimens were obtained at the following localities: Mill Creek, 260 feet; Dale's, 600 feet; two miles west of Black Butte, 6800 feet, July 5, 1924; Willow Lake, 5600 feet, July 19 and 24, 1924. Observed at the following additional localities: Red Bluff, 300 feet, May 13, 1924; Silva's, April 12, 1928; Cone's, 270 feet, April 6, 1928; Bloody Island, 350 feet; Mineral, 4800 feet, June 29, July 6 and 25, 1925; Broke-off Mountain at 8000 feet, July 27, 1925; Manzanita Lake, 6000 feet, June 8, 1926; Lake Helen, 8200 feet, July 15, 1924; Eagle Lake Resort, 5200 feet, May 15, 1925, June 12, 1929, and June 16, 1928; Spalding's, June 17, 1928; Gallatin's, 5200 feet, June 11, 1929.

A male from Dale's, May 20, weighed 9.7 grams. Three young but fully-fledged birds collected in the mountains in July weighed 7.7, 8.7, and 9.5 grams.

House wrens usually foraged close to or on the ground among low trees or in brushy places. Availability of suitable nesting sites appeared to be an important factor in the choice of local surroundings.

On May 15, 1925, a nest-building house wren was watched near Eagle Lake Resort. The bird carried twigs to the top of one of the tallest of the dead yellow pine stubs of that vicinity, fully fifty meters above the ground. The bird each trip moved upward by a well defined route, flying from limb to limb as though moving up a staircase. By the time the wren reached the nest in a crack at the top of the stub, the observer on the ground could scarcely trace its movements.

In the western end of the section, at Bloody Island, a nest containing young birds was found, May 28, 1926, two meters above the ground in a dead stub of an apple tree in an orchard. It was estimated that the entrance to the cavity was forty-five millimeters in diameter. Some of the sticks of the nest showed through the opening. Both parent birds came to the nest within a few seconds after it was discovered.

Near Mineral, June 1, 1927, a lone house wren was singing vigorously in the vicinity of a dead aspen stub. Several loose sticks protruded from a hole one and one-half meters up in this stub. No mate was around, and when this bird was approached closely it lost interest and went high in the live, thick lodgepole pines and disappeared. On June 16 the lone wren was still around and it was singing vigorously, but there were still no signs of a mate. Every now and then the bird went to the nest hole in the aspen stub. When the cavity was chopped out, a meager nest, of sticks only, was found—no lining.

On June 12, 1929, a single individual was seen about a nest near Eagle Lake Resort. The cavity was ten meters up in a yellow pine stub on the lake shore. Several sticks protruded from the entrance. The bird entered two or three times and poked its head out of the opening. Once it came out and perched on the protruding sticks. This bird spent considerable time singing. Within ten meters of the stub were occupied nests of chickadee and robin. The wren drove off a white-breasted nuthatch that was perching on a limb of the former's tree.

Near Spalding's, on June 17, 1928, a pair of house wrens was observed feeding young in a cavity in a stub ten meters high. In the same stub were cavities believed, from the behavior of adults, to contain young of the following three other species: pigmy nuthatch, western bluebird, and tree swallow. This instance becomes significant when it is recalled that in some parts of its range the house wren has been credited with being especially intolerant of close presence of other birds.

A well defined, post-nesting-season, up-mountain movement of house wrens was noted, beginning at Mineral in the late part of June. They then frequented the thickets of snow-brush and manzanita. Some of these individuals were observed singing brokenly.

Nannus hiemalis pacificus (Baird)

Western Winter Wren

December 20, 1927, two males of this species were collected near Mineral, on Martin Creek at 5000 feet. The two birds were about one-fourth of a mile apart. Each was near the ground in alders bordering a seepy place and close under cover of brush less than one meter above the snow, which then covered the ground. Attention was attracted to the wrens by their sharp calling when approached by the observer (Linsdale, MS). Close search of the same stretch of stream course in the summer of 1928 failed to reveal any trace of this species. The conclusion is that it is but a winter visitant, and sparingly so, to the western slope of the section.

Weights of the two males were 8.9 and 9.4 grams.

Thryomanes bewickii drymoecus Oberholser

Sacramento Bewick Wren

A resident of widespread occurrence in the western part of the section below the belt of coniferous trees. Present locally in the eastern part of the section, at least in summer (fig. 93). Skins were saved from the following localities: Blue Tent Creek, 300 feet; Red Bluff, 300 feet; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; Tuscan Springs, 1200 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; eight miles east of Payne Creek P. O., 2850 feet; eight miles southwest of Ravendale, 5600 feet. Observed also at: Sisson's, 270 feet; Cone's, 270 feet; four miles northeast of Red Rock P. O., 5400 feet.

Weights of five males collected in December averaged 9.5 (7.6 to 10.5) grams; seven females, 9.2 (8.4 to 9.7). Weights of three males, May, were 8.9, 9.5 (juv.), 9.8 (juv.) grams. Weights of four May-collected females were 8.9, 9.4 (juv.), 13.1, and 13.7 grams. A June-collected male weighed 9.7 grams. A male and female, full-fledged juvenals, from the eastern end of the section in July each weighed 10 grams.

The environmental circumstances which favor the presence of this wren are indicated in the following list of situations where birds were definitely observed or collected: accumulations of driftwood; riverside thickets; in brush under willows; near ground in willows along stream in cañon; near ground in thickets close to stream; on gravel at base of cottonwood; halfway up a valley oak at a creek-side; in small brush pile in wooded ravine; in dense brush in ravine; in thick dead brush; in tangle of prostrate dead oak under living oak; on ground at base of dead stump; at base of live oak; in top of live oak; in dead digger pine; in small blue oak; in buck-brush clump; in manzanita bush.

In nearly every instance, the birds were seen on the ground or on a perch barely above the ground. In situations so near to the ground visibility of the surrounding area is naturally much reduced, so that it is necessary for the birds to take advantage of any available screen for their activity. In this region most of the cover of this sort is furnished by vegetable features—logs, dead branches, and trash—that have fallen from trees or bushes. At the same time, these situations attract a large population of invertebrate animals upon which this wren feeds. The greater frequency of the species near streams may be accounted for by the greater amount, along streams than on the ridges and slopes, of vegetable material such as contributes to favorable cover. (See figs. 31 and 32.)

On almost every occasion when a wren of this species was seen out of its regular niche, it had evidently been attracted to the place, temporarily, by an especially favorable food source. For example, in April when insects were especially numerous in the foliage of live oaks, individual wrens were observed in the tops of those trees.

On May 4 and 9, 1924, females were collected near Red Bluff whose oviducts contained eggs nearly ready for laying. On May 26, 1926, a family of several young just out of a nest was flushed from a small brush pile near Bloody Island. Both parents called nervously in the vicinity. By May 22, 1924, young in the neighborhood of Dale's were out of their nests and widely scattered.

Telmatodytes palustris plesius (Oberholser)

Western Marsh Wren

Present in summer and fall at a few favorable places in the eastern portion of the section from Eagle Lake eastward. Three marsh wrens were obtained for specimens at Spalding's, 5200 feet, on October 13, 1923. Observed but not collected at the following additional places: Eagle Lake Resort, 5200 feet, May 23, 1925; Petes Valley, 4500 feet, July 14 and 15, 1928; Red Rock P. O., 5300 feet, July 24 and 26, 1928.

An adult male, an immature male, and an immature female, all taken October 13, weighed 10.2, 11.2, and 9.3 grams, respectively.

Marsh wrens in the section were seen over water in growths of *Typha* and *Scirpus,* and in thick patches of coarse marsh grasses.

Nest-building activity of this wren was noted on Eagle Lake on May 23, 1925 (fig. 142). In that and preceding years, tules were growing abundantly in the lake margin; in 1928 none was to be seen in exactly the same places, and not a marsh wren was observed there or at any other place visited around the lake.

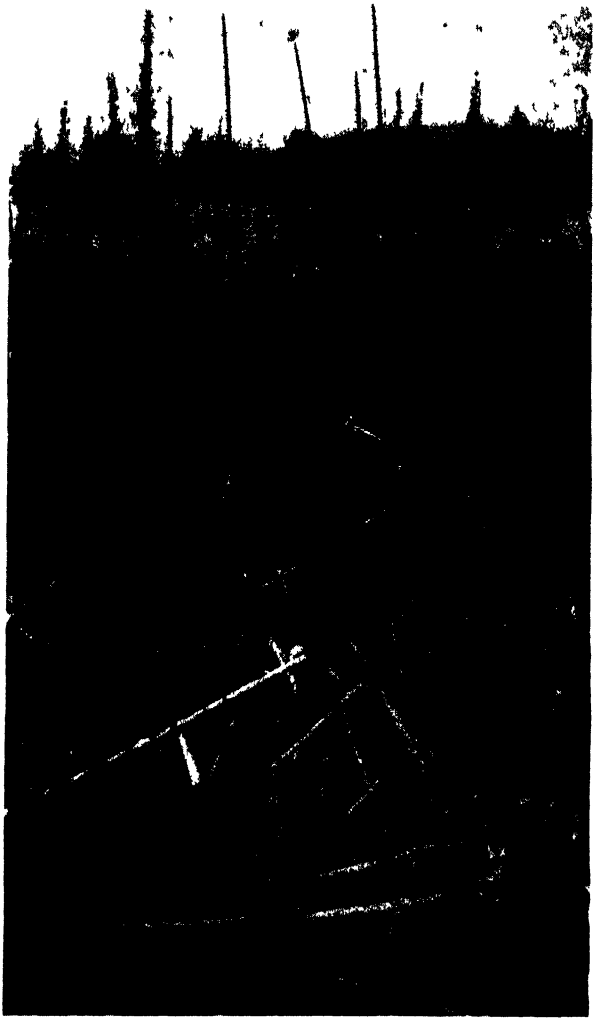


Fig. 142. Nest of western marsh wren (*Telmatodytes palustris plesius*) in edge of marsh of bulrushes. In years when there were no marshy areas around this lake no marsh wrens were present. Photograph taken May 23, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4664.

Townsend (1887, p. 227) records that, the last of June, 1884, "the conspicuous globular nests of this wren were found clinging to the stems of the tules wherever our boat penetrated at Eagle Lake. . . . ."

Catherpes mexicanus punctulatus Ridgway

Dotted Cañon Wren

A resident at a few places in the western part of the section (fig. 102). Collected at Dale's, 600 feet. Observed also at Antelope Creek, 600 feet, and at Elliott's, 1000 feet.

Two December-collected females weighed 10.4 and 12.6 grams.

Near Dale's this wren was found in winter about buildings, about stone fences, and around a lava ledge. Near Antelope Creek in December and April, and at Elliott's in April, the birds were seen about boulders at the bases of rocky cliffs.

In mid-winter only the hoarse call-notes of this species were given, but when the localities were visited in April the birds were giving their full songs.

Catherpes mexicanus conspersus Ridgway

Nevada Cañon Wren

Found in the eastern end of the section (fig. 102), where specimens were collected at: Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; four miles northeast of Red Rock P. O., 5400 feet. Also observed in Secret Valley, 4500 feet.

An adult male and female, July, weighed 12.6 and 12.2 grams, respectively. Three males and one female, all full fledged juvenals, in late July, weighed 9.4, 11, 11.5, and 10.2 grams, respectively.

This wren was found among the boulders on the outcrops along cañons and on steep slopes. Young birds out of the nest were observed during the second half of July, 1928. On July 11 an individual was seen carrying a large insect. On one occasion a singing bird when shot and examined proved to be a male young-of-the-year.

Salpinctes obsoletus obsoletus (Say)

Northern Rock Wren

Present in summer over most of the section; in winter found by us only on the western slope below 1600 feet altitude. Specimens were preserved from Dale's, 600 feet, and from toward Lassen Peak from Soupan Springs, at 7800 feet. Observed at the following additional places: seven miles east of Red Bluff, 700 feet; Payne Creek P. O., 1600 feet; toward Broke-off Mountain from Mineral, at 7000 feet; Lake Helen, 8200 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Prospect Peak at 7000 feet; Spalding's, 5200 feet; north end of Eagle Lake, 5200 feet; south end Grasshopper Valley, 5300 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; four miles northeast of Red Rock P. O., 5400 feet.

A male and a female collected at Dale's in December weighed 14.9 and 13.4 grams, respectively. An adult and two full-fledged young males collected there in May weighed 14.2, 16.8, and 18.1 grams, respectively. A laying female from near the trail toward Lassen Peak from Soupan Springs, taken on July 3, weighed 21.3 grams.

Among the types of rocky situations in which the rock wren was seen in the section are the following: lava jumble; amid lava boulders; black, fresh, broken-up lava in face of latest flow at Butte Lake (fig. 77); rocky cliff near stream; talus slope; rocky roadside bank; rimrock at edge of valley; human-built rock-wall, bordering roadside. Other places that were frequented were a barn and a vertical dirt bank.

On some of the accumulations of black lava rock the light colors of this species contrasted sharply with the dark background. Apparently, the question of protective coloration was not in these places an important factor in the choice of this type of habitat. In other words, the birds are not aware of their lightness of color when black rock masses are available to forage and nest in; also (or else), such conspicuous contrast there presenting itself (hypothetically revealing the wrens to potential enemies) does not operate disastrously (at once, at any rate) to those birds.

This species, of all the birds present in the section, seemed most closely adapted to conditions in those areas which had been affected by the most recent volcanic activity. Hence, this wren must have been among the first birds to invade the flows of broken lava.

At localities in the eastern part of the section, in July, 1928, rock wrens were numerous wherever there were rocks of any sort, even when they were well scattered over the surface of the ground. Individuals were then often seen perched in the tops of sage-bushes. In Petes Valley, on July 13, a bird was watched as it foraged over a boulder-covered slope. It hopped over the rocks and at intervals made quick dashes to some insect that had come to notice. When the object wanted was in a cranny or under a rock the wren would stay under cover for a short time only and would hurry back to a point from which it could look, unhindered, in every direction. Several times the bird flew into the air after a passing insect. Once it picked up a small pebble which it soon dropped.

On May 29, 1924, near Dale's, a pair of adult rock wrens and five young just able to fly were observed inside a barn hopping about the mangers and timbers as though at home there. Possibly the nest had been situated somewhere in the barn.

At Butte Lake, in mid-June, 1926, adults were seen carrying insect food, presumably for young. On June 27, 1928, at the same place, partly grown young were seen, out of the nest.

An empty nest of the rock wren was found, July 13, 1928, in Petes Valley. This was located in a hole in the vertical dirt bank of a dry wash. The hole was three-fourths of the way to the top of the bank, which was slightly over a meter in height. The diameter of the cavity was close to eight centimeters. The floor of its entrance was neatly paved with flat stones varying from one to two and one-half centimeters in diameter.

The rock wren population was greater in the Great Basin portion than in any other part of the section. On July 18, 1928, when young were out in family groups, five hours of observation at a point eight miles southwest of Ravendale resulted in seeing thirty-four individuals. In the western part of the section rarely more than four or five were seen in one day. If this difference in density of population may be considered as an index to the favorableness of the environment, then it would seem that conditions in the eastern part of the section are more favorable than the ones in the western end. Mere rockiness of terrain is quite as extreme in certain square miles in the vicinity of Dale's and on the slopes of Broke-off Mountain and Lassen Peak as it is in similarly sized areas in the vicinity of Ravendale. Therefore eliminating this one, the remaining factors of environment which are most apparently different between the two ends of the section are the ones connected with various phases of humidity. Our censuses indicate that this species thrives best in the drier habitats.

Mimus polyglottos leucopterus (Vigors)

Western Mockingbird

Of apparently rare occurrence in both the extreme western and extreme eastern ends of the section.

On July 5, 1928, a mockingbird was seen in a tree at the roadside bordering an orchard one and one-half miles east of Red Bluff.

Close to the Tuledad Road, two miles west of Red Rock P. O., an unexpected find was made on June 19, 1928; namely, of a nest of the mockingbird. This was situated in a thick-topped sage-bush, the rim 78 centimeters above the sandy surfaced ground. A female was brooding four eggs which proved to be on the point of hatching. After this bird was shot, a search was made for its mate; but no sign of it was found (Grinnell, MS).

The female, which was preserved (no. 53050), weighed 47.9 grams.

The eggshells in the above nest were saved (no. 2336) and prove to match well with the usual type of mockingbird egg in all respects. The nest itself is a coarse structure, rather shallow (inside depth 45, diameter 84 mm.); lining chiefly of long, fine, yellowish rootlets, with a few white horse-hairs; externally, especially on the side away from the stem of the sage-bush, of coarse straggling twigs, some of them branching, of sage and rabbit-brush.

Toxostoma redivivum sonomae Grinnell

Sonoma California Thrasher

Specimens of this species resident in the western portion of the section were collected at Manton, 2300 feet. Observed also at Red Bluff, 300 feet, and on the slopes of Inskip Hill.

An adult male collected April 21 weighed 109.8 grams. Two adult males collected in late May and early June weighed 96.6 and 98.2 grams. Two April collected adult females weighed 100.8 and 103 grams. Four fully fledged young males, May 30 and June 3 and 4, weighed 82.5, 90.5, 90.8, 93.9; one female of similar age, taken June 4, weighed 99 grams.

The only California thrasher seen in the near vicinity of Red Bluff was one on May 13, 1924, perched in full song on a mistletoe clump in a tree standing on the bank of the river.

On December 27, 1927, on the eastern base of Inskip Hill, the locations of at least two pairs of thrashers were determined by their occasional *chucks* and half-hearted singing. Here was an almost pure stand of scrub oak (fig. 42) of small size occupying a tract of many acres of ground composed of small pumice rocks and gravel. Considerable search resulted only in one view of a bird perched in a small leafless black oak rising a little above the chaparral. Other individuals that were present at that season on the south and west bases of Inskip Hill seemed to sing more during the hour just before sundown than in any other part of the day. None of the thrashers encountered in December would permit a close and unscreened approach by the collector.

In the neighborhood of Manton, where this bird was observed in April and June, there were considerable areas of scrub oak chaparral. In April the birds were singing from the tops of dead digger pines, or stumps of them, in dense brushy tracts. Others were seen in clumps of scrub oak or on the ground between those clumps. A few also frequented clumps of buck-brush.

On April 20, 1928, a nest was found near Manton in the center of an isolated clump of buck-brush. It was less than a meter above the ground. An adult was brooding two eggs. The bird flushed when the bush was shaken and returned silently after two or three minutes. The nest was typically shallow and was lined with shreds of bark and fine material.

Another nest in the same vicinity, found on April 21, was one and one-half meters above the ground in the center of a medium sized clump of scrub oak. The spaces between the clumps here were sufficiently open to permit a person to walk through them easily. Many dead and charred stubs of pine were standing close by, with accumulations of dead sticks and brush on the ground. The adult, which was brooding three eggs, left the nest when the bush was touched.

One hundred and fifty meters down the slope from the nest last described was a third nest, in a similar situation, except that this one was in a smaller scrub oak and it was only three-fourths meter above the ground. This nest, too, contained three eggs. The brooding bird flew off when approached to within three meters. This one or another remained in the vicinity and sang from the tops of dead trees which projected above the bushes. This nest was more loosely constructed and it was shallower than others that were found.

On the same morning still another nest was seen, one meter above the ground, in an especially dense thicket of scrub oak. In this nest were two downy young. On the nest rim was an eggshell with a hole in one side and the contents drained. The parent birds were not noisy though both came close to the nest, mostly on the ground, and called nervously although infrequently.

Young thrashers out of their nests and fully feathered were conspicuously present near Manton in late May and early June of 1926. These young birds were easily approached by a collector, just as were the adults in the early part of the nesting season when eggs were in the nests. This behavior contrasted markedly with that of adults in midwinter, since they were then especially wary and difficult of approach.

The small number of eggs in a set laid by this bird argues that its habitat must be relatively free from enemies or dangers that ordinarily levy draft upon birds of this character of behavior and size.

The small number of individuals found in the section is probably due to the species being restricted to a type of brush cover (scrub oak) that is found there in areas of only small size. At Manton in mid-April, when only adults were present, more than ten individuals were seen or heard during one morning's observation, and that on ground where progress for a person was necessarily slow because of the dense brushy cover.

Comparison of the series of ten skins from the neighborhood of Manton with material from elsewhere, always taking stage of plumage into account, places them with the subspecies *sonomae* of northwestern California rather than with *redivivum* of the Monterey district or the San Joaquin Valley. At the same time, a certain proportion of the reddish tone of color shown by the adult Tehama County birds, especially ventrally, must be diagnosed as adventitious. This color tone is suggestively close to that of the predominant color of the soil in the same neighborhood.

Oroscoptes montanus (J. K. Townsend)

Sage Thrasher

A summer visitant to the Great Basin portion of the section, that is, eastward from Eagle Lake. Specimens were obtained from the south end of Grasshopper Valley, 5350 feet; Petes Valley, 4500 feet; Red Rock P. O., 5300 feet. Observed also at north end of Eagle Lake, 5200 feet; Horse Lake, 5200 feet; Termo, 5300 feet; seven miles south of Ravendale, 5400 feet; three miles south of Ravendale, 5300 feet.

Two adult males collected in June weighed 37.2 and 38.2 grams. One taken, July 11, weighed 42.9 grams.

Sage thrashers lived on ground that was well covered with sagebrush. The birds were further restricted to those areas where these plants grew close together and to a height of more than a meter. Where fence posts projected slightly above the tops of surrounding bushes they were used as perches.

Occasionally, when retiring from the path of an intruding observer, the thrashers flew over the tops of the bushes; but more often they retreated by running over the ground in such a manner that the bushes served constantly to screen their movements from human eyes.

One mannerism of this species that was especially noticeable when the birds perched on fence posts was to raise the tail quickly and then lower it slowly.

When the vicinity of Red Rock P. O. was visited on June 19, 1928, sage thrashers were heard in full song almost continuously even through the night, with scarcely a pause. One or another bird within hearing was nearly always singing. The song was of a much more pleasing type than is that of the mockingbird. A month later, July 21 to 26, at the same place, no songs of this species were heard although the birds were present.

A family group of bob-tailed young was seen near Red Rock P. O. on July 21, 1928. The young birds hurried away, running on the ground. Several other groups of young with adults, each numbering from three to six individuals, were observed at this place. The young thrashers seemed to be not timid since they regularly permitted close approach by an observer.

A used nest of this species, one-half meter above the ground in a sage-bush, found at Petes Valley, July 15, 1928, contained a single egg that had never hatched.

In Petes Valley on June 9, 1929, a nest was found one-half meter above the ground in a sage-bush one meter high. The structure was of coarse sticks and was lined with shreds of bark and a few bunches of sheep's wool. The set contained four eggs. When the brooding bird was disturbed it jumped to the ground and ran off between the sage-bushes which there were scattered, with bare ground between them.

On June 17, a nest was found in the center of a small clump of rabbit-brush seven miles south of Ravendale. This one was 30 cm. above the ground, to rim. There was a small pile of dead brush near-by. Otherwise scraggly clumps of rabbit-brush made up the bulk of the vegetational cover. The ground between the bushes was nearly bare. The nest was loosely built of dead sticks and was shallowly lined with shreds of bark. Inside depth was 80 mm. The lining extended only halfway up the sides. The inside diameter at the rim was 11 cm. The five eggs in the nest had the spots collected into distinct rings almost midway between the two ends. One bird gave alarm notes when the observer came near the nest but the brooding bird stayed until approached within three meters.

Two nests were found June 19, 1929, on Madeline Plains three miles south of Ravendale. Both were in clumps of sage-brush; one 54 and one 55 cm. above the ground. Each nest was composed of dead twigs of sage-brush and was lined with shreds of bark. Each set had contained four eggs, but from one nest an egg had got outside onto the ground. From one of the nests the brooding bird flew off when approached within four meters. It soon returned and ran about the site on the ground, but was silent.

In 1905, Sheldon (1907, p. 190) found the species "breeding in sage-brush" on the northwest side of Eagle Lake. Birds and a set of three fresh eggs were taken on July 8; "nest placed in sage brush six inches from the ground."

Turdus migratorius propinquus Ridgway

Western Robin

Present in one part of the section or another at all seasons; in winter restricted to the lower, westernmost portion. Specimens represent the following localities: Dale's, 600 feet, May 24, 1924 (also observed in April, June and December); eleven miles east of Payne Creek P. O., 3500 feet, December 31, 1924; Mineral, 4900 feet; Termo, 5300 feet, October 10, 1924. Observed also at the following additional localities: Payne Creek P. O., 1600 feet, December; Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Turner Mountain at 6000 feet; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet, September 10, 1923; Drakesbad, 5500 feet, September 26, 1923; Willow Lake, 5600 feet; Kelly's, 5200 feet; Prospect Peak at 7500 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake (5200 feet) at Eagle Lake Resort, Spalding's, Gallatin's, and at the north end of the lake; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Jones', 5400 feet.

Three adult males taken in May, October and December weighed 83.0, 95.6 and 93.7 grams, respectively. A young male, bob-tailed, just out of its nest on May 24, 1924, weighed 64.4 grams.

In fall and winter robins congregated where there was an abundance of suitable food, chiefly fruits. In those places the birds, in flocks, fed either on or off the ground, depending on the location of the food source. In the spring, pairs established themselves around meadows, or close to small clearings at the borders of lakes or streams, or in farm yards. Most of their foraging in such situations took place on the ground, while the trees were used for singing perches and other activities connected with nesting.

On May 7, 1927, robins were the most conspicuous birds on Battle Creek Meadows. They were not singing, but were scattered over the frost-mellowed and muddy, nearly bare, ground. Birds that were nesting, in June and July, at the borders of lakes such as Butte Lake and Eagle Lake, habitually foraged at the water's edge and carried the results to young back in the woods.

At Mineral, June 10, 1928, when there was a drizzling rain and the woods were dripping, robins were in full song in spite of the cold and gloominess, thus giving the impression that the shade and moisture appealed to these birds; for other birds were then quiet. May 27, 1927, snow fell through the day at Mineral. Despite the snowfall there was a chorus of robins at daybreak although most other birds were quiet then and throughout the day.

An example of this bird eating an item of large bulk was noted May 20, 1924, near Dale's. Early in the morning a robin lit in a tree near an observer. It was carrying a tree-toad in its bill. The bird became alarmed at the close presence of a person and swallowed the tree-toad head first.

On June 21, 1929, near Bogard R. S. a robin was seen to fly several meters into the air in pursuit of an insect which it caught and carried to the ground to be eaten.

Fruits (chiefly of native plants) were eaten under widely varying conditions of season and place within the section. At Manton on April 19, 1928, a good sized flock of robins was feeding on berries in an ornamental vine growing over a frame on a house. In an orchard in the same vicinity, about the first of June, 1926, individuals were eating cherries and mulberries. Near Mineral in early August, 1925, robins, both young and old, were resorting to the ripening fruit of the service berry. In October, 1924, close to Termo, where juniper berries (figs. 59 and 60) were ripening and falling upon the ground, many robins were congregated under the trees and feeding there. Beneath many of the trees there were as many as six birds. On the southern slope of Inskip Hill on December 22, 1927, fully thirty robins were gleaning red manzanita berries from the ground beneath the bushes. At that place and lower in the section, at this same season, these birds were seen about clumps of mistletoe in tall trees.

Many robins were observed, 10:30 to 11:30 A.M., December 31, 1924, bathing in a snow-water streamlet at 3500 feet, eleven miles east of Payne Creek P. O. Snow covered much of the ground in the vicinity.

An instance demonstrating a constant source of danger to many birds of the vicinity was noted near Mineral when a broken-winged robin was found, May 11, 1927, beneath a line of telephone wires. Evidence showed that this one had flown against a wire.

Kinds of trees in which nests were found, with their respective heights from the ground, in meters, are as follows: valley oak (5); willow (1 and 1¼); cottonwood (5); alder (3.2); yellow pine (5 and 16); Jeffrey pine (16); lodgepole pine (1.7); white fir (1.5 and 2.5); aspen (6); juniper (1 and 3). The nest trees were nearly always closely accessible to some stream or lake, and usually they were in or close to a meadow or some other type of open ground. Two factors, seemingly the important ones, in the choice of a nest site were the availability of mud for nest material and accessibility of open, usually moist, ground where the adults might forage for animal food. It is evident, from the facts given above, that the birds can find suitable places for support of nests in many different types of plants. The wide range of height from the ground of these nests indicates that this feature is a function, chiefly, of the kind of plant which results in each case in a different growth-form.

Robins were observed carrying materials for nests at Dale's on April 14, 1928, and May 19, 1924; at Turner's, April 28, 1928; on Battle Creek Meadows, June 23, 1925; at Wilson Lake, May 24, 1927; Bogard R. S., June 21, 1929; at Petes Valley, June 10, 1929. Nests containing eggs of numbers indicated were found as follows: Mineral, June 18, 1927 (4) and July 11, 1925 (2, still unhatched on July 26); Manzanita Lake, June 8, 1926 (3); Wilson Lake, May 24, 1927 (3); Bogard R. S., June 20, 1929 (4); Eagle Lake Resort, June 12, 1929 (3). Young birds in nests were found at Manzanita Lake, June 12, 1926 (3), and at the north end of Eagle Lake, June 18, 1928 (3 newly hatched, and 2 in another). Young robins recently out of nests were seen earliest on the following dates: Manton, June 3, 1926; Antelope Creek at 3000 feet, June 8, 1924; Battle Creek Meadows, June 7, 1928; Mineral, June 10, 1928; Butte Lake, June 19, 1926; Bogard R. S., June 20, 1929; Petes Valley, July 19, 1928.

It appears from the above data that in this bird two broods may be raised in a single nesting season and that nesting begins and probably ends earlier in the lower western part of the section than in the higher portions.

At Dale's in May, 1924, at least six pairs of robins were nesting within 200 meters of one place. At several of the collecting stations in the mountainous portion of the section this was the commonest bird present in summer.

Ixoreus naevius naevius (Gmelin)

Coast Varied Thrush

In the California Academy of Sciences is a specimen (no. 4281, J. and J. W. Mailliard coll.) taken by J. M. Willard at or near Eagle Lake, December 5, 1899. This specimen, a female, has been compared and found definitely to fall with the species *naevius* rather than *meruloides*.

Ixoreus naevius meruloides (Swainson)

Northern Varied Thrush

Found at Dale's, 600 feet, in December, 1924, where specimens were collected. Also observed eleven miles east of Payne Creek P. O., 3500 feet, December 31, 1924. On April 19, 1929, three varied thrushes were seen in the neighborhood of Mineral, 4900 feet; two were at the edge of a meadow and one at a roadside.

Two males collected December 20 and 25 weighed 86.8 and 79.3 grams, respectively.

In the vicinity of Dale's this thrush was observed in valley oaks or on the bare ground beneath trees of that species in the bottomland; also, but less commonly, on the adjacent upland, in blue oaks. At the 3500-foot level east of Payne Creek P. O., the birds observed were among black oaks, yellow pines, and scattering manzanita thickets. We have only one record from the section for any year other than 1924; it is likely that this species is of irregular presence there from year to year.

Hylocichla guttata guttata (Pallas)

Alaska Hermit Thrush

A transient through most of the section and a winter visitant in the western part of it. Specimens were obtained at the following places: Cone's, 270 feet, December; Dale's, 600 feet, December; south face of Inskip Hill, 1800 and 2000 feet, December; five miles north of Fredonyer Peak, 5700 feet, October 5, 1924; Termo, 5300 feet, October 11, 1924. Observed also ten miles north of Red Bluff, 500 feet, April 8 and 10, 1928; at Blue Tent Creek, 350 feet, January and December; Silva's, 270 feet, April 13, 1928; Manton, 2300 feet, April 18, 20, 21, 1928.

Two December-collected males weighed 23.2 and 25.7 grams. Two females collected in December weighed 21.6 and 25.2 grams. Two females, birds-of-the-year, from the eastern part of the section, in October, weighed 22 and 25.5 grams.

This thrush, although most often seen on the ground or on some low perch, was sometimes observed high in trees. It seemed to prefer to forage over ground that was well covered with bushes and shrubby vegetation. On the southwest slope of Inskip Hill, on December 22, 1927, hermit thrushes were numerous in the dense chaparral, gleaning from the ground the fallen manzanita berries.

Hylocichla guttata sequoiensis (Belding)

Sierra Hermit Thrush

A summer visitant to the mountainous portion of the section above 4800 feet altitude, from Battle Creek Meadows eastward to the southwestern end of Eagle Lake. Specimens were obtained from the following localities: Mineral, 4900 feet; ridge two miles northeast of Mineral, 5500 feet; Summit Creek, 5200 feet. Presence of the species attested by observation at the following additional places: Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Prospect Peak at 7500 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet.

Sheldon (1907, p. 191) took a specimen near Pappoose Valley, south of Eagle Lake, July 1, 1905.

A male taken June 17 weighed 25 grams. An adult female, July 29, weighed 23.6 grams. A young male, nestling, taken June 29, 1925, weighed 24 grams.

The earliest singing individual on the breeding ground was heard May 11, 1927, near Mineral. A late date for a singing bird was July 26, 1925, when a full song was heard, but only for a few minutes, from some firs in the edge of Battle Creek Meadows. The latest occurrence recorded by us in summer was on July 29, 1925, when one was shot in a fir on top of a dry ridge near Mineral.

Thrushes were heard, June 28, 1928, on the east slope of Prospect Peak even though there was then no water anywhere on the slope. On July 3 when observations were made on the floor of the cañon of Martin Creek, this was one of the few species of birds that was present in numbers in the deeply shaded woods of the cañon bottom and lower adjacent slopes. Firs of both species, lodgepole pines, and incense cedars were the trees most often associated with this bird in its summer habitat. It foraged on dryish forest floors, but where such were heavily shaded.

In the neighborhood of Mineral the earliest nest of hermit thrush was found May 28, 1927. The site was in deep, dark fir woods with lodgepole pines and aspens close by. The nest was slightly over one and one-half meters above the ground, saddled at the intersection of a dead fir stem four centimeters in diameter slanting at a forty-five degree angle against a live young fir stem nine and one-half centimeters in diameter. The slanting stem and emanating dead twigs furnished most of the support.

In mid-afternoon of the day it was found, the nest was empty. At four o'clock on the next afternoon a bird was at the nest, sitting so closely that the observer approached to within one meter of it. Then the bird left, disclosing one egg. Whether incubation had already started, or this first egg had but just been deposited, could not be determined. On June 1 the bird was sitting closely upon three eggs. As this number had not been increased by June 3, it was thought to constitute a full set. The closely brooding bird when disturbed would fly to the ground and disappear.

On June 10, 1928, near Mineral, a nest containing two very small young and one egg was found. This nest was one meter above the ground resting among the intercrossing twigs between the vertical stems of two small trees, an incense cedar and a yellow pine. These little trees stood in an open space about twenty-five meters from a stream in a shallow ravine. Black oaks, firs, and cedars grew round about. The nest had much of a fine-textured black lichen in its rim.

Another nest found June 13, 1925, close to a meadow near Mineral was twenty-five meters from the edge of a willow bog and was well shaded beneath a group of lodgepole pines twenty-five to thirty meters high. Also there were tall firs close by, from the tip of one or another of which within 100 meters of the nest the male sang a good deal of the time. The nest rim was eighty centimeters above the ground, supported mainly by the branches of, and against the stem of, a little incense cedar, but also by twigs from a small lodgepole pine (fig. 143). Neither tree was more than two meters in height. The bases of the little trees were surrounded by veratrum nearly to the height of the nest rim. When first observed, the female was brooding low in the nest with bill elevated and tail at a thirty-degree angle from the horizontal. All the four eggs in this nest hatched on June 18. On the morning of the 20th the young already appeared huge, but their eyes were still closed. Two segments of an eggshell, adherent at one part of the periphery of the egg membrane, were found about fifteen meters away in an open cow trail where it was surmised the female thrush had carried them from this nest. An adult brought insects to the nest June 20, but the bird proved to be shy. On June 29 this nest was empty save for the remains of one dead young one. A singing bird was heard daily in the vicinity of this nest at least until July 19.

On June 20, 1925, a nest was found beside a small fir but entirely supported by the stem and twigs of a broken-down young cedar. This one was a meter above the ground and was easily visible for fifteen meters in any direction. The site was in the heavy shade of firs and lodgepole pines, about thirty meters from the edge of a willow bog. In the nest were four small young of almost exactly the same size as the birds in the nest last described. A bird was brooding closely, but when approached to within half a meter it left for the ground, and trotted off hesitantly but silently over the ground and over logs. On June 29 the four young thrushes, although far from fully fledged, left abruptly in four directions when the nest was touched by the observer. Each went over and under logs and brush with amazing celerity, and with cries that brought a distracted parent.

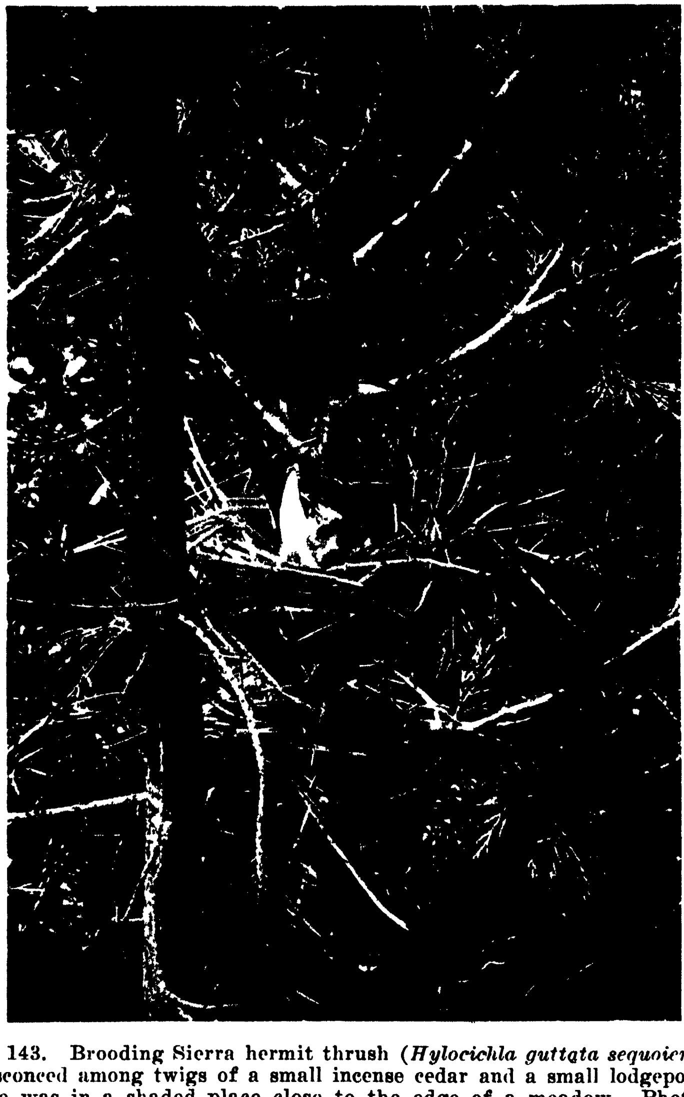


Fig. 143. Brooding Sierra hermit thrush (*Hylocichla guttata sequoiensis*) on nest ensconced among twigs of a small incense cedar and a small lodgepole pine. The site was in a shaded place close to the edge of a meadow. Photograph taken June 14, 1925, at Mineral. Mus. Vert. Zool. no. 4654.

On June 22, 1928, a family of hermit thrushes was being convoyed scatteringly by at least one adult over the darkly shaded forest floor one mile west of Mineral. At the same time, two males were heard overhead in the vicinity, in full song right through the heat of the cloudless day (J. and H. W. Grinnell, MS).

The two adult specimens taken are each smaller (wing length taken as criterion of size) than *sequoiensis* of the central Sierra Nevada (Yosemite region), and yet they are larger than *slevini* from due west across the Sacramento Valley, on the Yolla Bolly Mountains. There is thus strong evidence that at the higher altitudes around the head of the Sacramento Valley complete intergradation between these two forms takes place. The wing lengths of the birds in question (from vicinity of Mineral) are: no. 45323, ♂, 92.8 millimeters; no. 45906, ♀, 84.1.

Hylocichla ustulata ustulata (Nuttall)

Russet-backed Thrush

Found in the section in summer as far eastward as Kelly's. Specimens represent the following stations: Dale's, 600 feet, May 19, 20, and 24, 1924; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet, observed earliest, May 17, 1924; two miles west of Black Butte, 6800 feet; Kelly's, 5200 feet. Observed also at Mill Creek, 260 feet, June 8 to 12, 1912, and Summit Creek, 5200 feet, June 17, 1924.

Weights of three adult males collected in May were 29.7, 30, and 34.8 grams. Three adult females taken in June and July weighed 28.8, 29.5, and 31.7 grams.

Russet-backed thrushes that lived in the section in summer were restricted closely to clumps of shrubby vegetation, chiefly willow and white alder growing in moist places—either bordering streams or on wet ground, as in the lower mountain meadows. Individuals that were thought to be transient through the section in late spring (at Dale's) were limited less closely to the usual type of summer habitat, being found even in blue oaks and buck-brush out on the lava-covered uplands.

In a willow bog on Battle Creek Meadows a nest of this thrush was discovered on June 29, 1925. The site was in a rather low willow clump, with clumps of taller willows and white alders close by, separated from one another by openings grown to lush grass and buttercups. A meadow stream was located six meters away. The green leafage above and all about the nest effectively concealed it from view. The nest was supported on a slanting willow stem plus adjacent twigs and foliage. The rim was 78 centimeters above the ground. The four eggs in the nest were nearly ready to hatch.

On July 3, 1928, a nest was discovered in an alder tract in the cañon of Martin Creek, near Mineral. The nest rim was 1.8 meters above the wet ground; of usual construction although much flattened; situated on a slanting, multiple-crotched alder stem, in conspicuous view from below. When approached closely, the two adults, equally solicitous, made a great disturbance and at the same time the four young left the nest in different directions. So successful was this demonstration, that only one of the young could be located a minute or so later.

Of the specimens taken in the section, those collected at Dale's in May, and from their behavior thought to have been transients, are of decidedly the richer, browner tone of color, as to dorsum, chest, and flanks. The specimens from Mineral east to Kelly's, and undoubtedly on their breeding grounds, are less richly brown, and thus suggest a tendency toward the slaty-toned race *swainsoni,* as represented in the breeding season farther to the eastward, in the Warner Mountains of Modoc County. Indeed, we are now quite convinced of the existence of regular intergradation between *ustulata* and *swainsoni,* so that the trinomial is in order—this having been a moot point in fairly recent discussions of status in this group of thrushes.

Sialia mexicana occidentalis J. K. Townsend

Western Mexican Bluebird

Resident in the section; most abundant at the western end below the 3500-foot level. Our summer records of this species extend sparingly up to 7000 feet altitude; winter records up to 5000 feet. Specimens represent the following localities: ten miles north of Red Bluff, 500 feet; Blue Tent Creek, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Spalding's, 5200 feet, October 19, 1923; five miles north of Fredonyer Peak, 5700 feet, October 1, 1924. Recorded from the following places by observation only: Red Bluff, 300 feet; Cone's, 600 feet, December; Bloody Island, 350 feet, May; Tehama, 250 feet; Elliott's, 1000 feet; Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Mineral, 4900 feet, May, June, July and December; two miles west of Black Butte, 6800 feet, July; Eagle Lake Resort, 5200 feet; Gallatin's, 5200 feet; eight miles southwest of Ravendale, 5600 feet, July 19, 1928.

Seven males collected in the western part of the section in December weighed 26.1, 27.1, 28.0, 28.6, 29.0, 30.6, and 30.6 grams. One from the eastern part of the section, October 1, weighed 29.7 grams. Three December-collected females weighed 25.6, 26.1, and 30.5 grams.

In summer western bluebirds were to be observed about clearings and in those places where the cover of trees was sparse. Individuals and pairs when not in flight were most often seen perched in the tops of dead or dead-topped trees. In addition to the greater likelihood of there being suitable nest sites at these places, the open nature of the available perches there may have operated in the choice of them as lookouts whence to see passing insects or insects upon the ground round about. These suggestions do not exclude the possibility of still other factors operating to account for this observed choice.

On July 25, 1929, several western bluebirds were seen about the blasted pine stubs in the devastated area near Hat Lake (fig. 40), northeast of Lassen Peak.

The presence of mistletoe berries in quantity (fig. 57) appeared the chief positive factor in determining the presence of flocks of this bluebird in the western part of the section in winter. Severity of the weather seemed to be not effective in driving away birds of this species, so long as it did not affect the availability of this source of food.

On July 6, 1925, the call-notes of this bluebird were heard from the sparse blue oaks on the glaring hot, lava-strewn plains above Dale's.

On April 24, 1928, a bluebird at Cone's was seen to fly with food in its bill, from the ground in a field to a tree at the edge of a creek. Near Bloody Island on May 25, 1926, two bluebirds were observed on dead stubs close to the river. One of these birds started to fly across a clearing. When halfway across, the bird checked its flight and hovered in the air much as sparrow hawks occasionally do. Then it dropped straight to the ground and picked up a large insect which it carried to a tall, dead stump. Seemingly, although the birds often forage for insects upon the ground, they tend to carry the quarry to some perch in a tree to be eaten.

Near Gallatin's on June 11, 1929, a western bluebird was watched as it perched on dead snags and several times flew after insects in the air. The insects which were flying in groups were too small to be seen by a person on the ground except by the aid of binoculars. The bird would fly after several insects before going to a perch from which it would start anew after a short wait.

Western bluebirds were observed in small groups, through the winter and as late in the spring as the middle of April. After that time pairs were seen, usually about some prospective or actual nest site.

A female that had recently been brooding was taken, May 8, 1924, near Red Bluff. On May 15, 1925, near Eagle Lake Resort, bluebirds were prospecting for nesting sites. Two adults were feeding young, June 3, 1926, in a nest hole six meters above the ground, in a charred yellow pine stub near Manton. At Mineral an adult female was found incubating, June 9, 1928, on a nest in an old rotted-out woodpecker hole in a charred tree stub. The hole was a little over two meters above the ground. On June 16, 1928, near Eagle Lake Resort at least three pairs of bluebirds were observed carrying food to young in nests between two and thirty meters above the ground in yellow pine stubs. A nest containing young birds that was found at Lyman's, June 14, 1924, was in an old woodpecker hole four meters above the ground.

A nest was found June 12, 1929, in the stub-forest near Eagle Lake Resort. The nest was two and one-half meters up in a hole in a yellow pine stub. Both parents were carrying food to young in the nest. Foraging was done in the stub-forest, on the ground, on the dead trunks, and in the air. The birds usually flew directly to and from the nest, not perching on any near-by limbs. Sometimes one would pause for a moment at the entrance before entering.

Young bluebirds were seen out of the nest near the collecting station on Mill Creek as early as June 8 (1912). On Battle Creek Meadows a family group was observed, July 2, 1925.

The one bird obtained in the eastern part of our section, male, no. 45679, near Fredonyer Peak, October 1, is longer winged and has more extensive chestnut both above and below than the birds from the western end. Wing, 110.5 mm.; tail, 65.7; bill from nostril, 9.6. Whether this bird was migrant from some point in the Great Basin farther east or northeast, or whether it represents a locally breeding population, we have at this time no means of knowing.

Sialia currucoides (Bechstein)

Mountain Bluebird

A summer visitant to the higher parts of the section eastward from Battle Creek Meadows. Occasionally present in winter on the western slope of the section. Specimens were obtained at the following places: Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Butte Lake, 6100 feet; Eagle Lake Resort, 5200 feet. Observed but not collected at the following additional places: Dale's, 600 feet, December 18, 1927; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Snag Lake, 6100 feet; Bogard R. S., 5500 feet; Slate Creek, 5700 feet; seven miles southwest of Ravendale, 5600 feet; Termo, 5300 feet; Box Springs, 5300 feet.

C. H. Townsend (MS) obtained specimens at Red Bluff, December 22, 1884.

Two adult males collected in May and June weighed 27.2 and 30 grams. A fully fledged young female, June 9, weighed 26.1 grams.

The presence locally of this species within its summer range seemed to be largely determined by the availability of suitable nesting holes in trunks of trees or stubs. Pairs that behaved as if prospecting for nest sites were observed in the stubs around the shore of Eagle Lake on May 14, 1925.

At the lower western end of Battle Creek Meadows on May 16, 1927, a male and two female mountain bluebirds were watched. The females were frequently quarreling. The male went to the top of a dead lodgepole pine and gave a weak series of low mellow notes, hardly more than a repetition of the usual call note. The male then got a small grass stem and went to an old woodpecker hole two meters up in the trunk of a living aspen. One or the other of the females prospected around that and other similar holes in the vicinity, but the male seemed to have picked upon that particular one. He showed solicitude when the observers came close to the site, although the females went off indifferently. Nest-building, evidently, was not yet seriously under way.

On June 1, the male and only one of the females were present at this site. The female was busy carrying nest material into the cavity.

On June 16 this nest contained five well-incubated eggs. The horizontal diameter of the entrance was 65 millimeters, the vertical diameter, 60. The rim of the built nest inside was 80 millimeters below the lower lip of the entrance. The nest consisted of, and was lined with, coarse rough outer bark (of willow?). Pivoting against this rough bark in the process of nest-building may have resulted in the remarkably worn condition of the contour feathers on the breast of the female, as noted when the bird (no. 51266) was collected. The cavity of the nest proper was 65 millimeters across by 30 deep. The nest was resting on a great quantity of rotten-wood chips, these partly filling up the original woodpecker's hole which had probably been enlarged by some intermediate occupant.

On June 5, 1926, a nest was found in a dead yellow pine stub one-half mile south of Manzanita Lake and on a chaparral-covered slope. The nest cavity was ten meters above the ground. The two parent birds perched on dead limbs of the stub and repeatedly drove away a pigmy nuthatch that was trying to enter a smaller hole higher in the stub. This "quarrel" continued for as long as the birds were watched, about fifteen minutes. The female bluebird left the perch and later returned carrying some insects which it took into the nest hole, evidently to feed young there. Young birds in this nest were still being fed on June 7.

A young female mountain bluebird just out of a nest was obtained, June 9, 1926, from the top of a tall dead tree close to Manzanita Creek.

On June 16, 1928, near Eagle Lake Resort, a male mountain bluebird was seen to leave a nest hole ten meters above the ground in a stub that was topped by an occupied osprey's nest. An adult bluebird was seen bringing food to young birds in a bird box on a pole across the road from the store at Termo, June 18, 1928.

Several pairs were observed, June 12, 1929, on broken stubs and foraging on the open ground near Eagle Lake Resort. One pair that was watched seemed to hold a certain stub for its own. The male repeatedly flew at and drove off Brewer blackbirds which alighted on limbs of the stub. The female did not attack the intruding birds.

On June 18, 1929, two adults were feeding young in a nest box on the roof of a shed at Box Springs. Most of the foraging was being done out on an adjacent meadow.

Myadestes townsendi (Audubon)

Townsend Solitaire

Present in summer in the mountainous part of the section from 4800 feet up to 8200 feet altitude. Fall and winter records are on the lower ground to the eastward and westward. The following localities are represented by specimens: eleven miles east of Payne Creek P. O., 3500 feet, December 31, 1924; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet, September 26, 1923; Merrillville, 5000 feet, September 30, 1915; Termo, 5300 feet, October 12, 1924; Dransfield's, 5300 feet, January 8, 1926. The species was observed, but no specimens obtained, at the following places: Dale's, 600 feet, May 7, 1927; Turner Mountain at 6000 feet; vicinity of Mineral, 4900 to 6000 feet; Manzanita Lake, 6000 feet; Lake Helen, 8200 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet, September 2, 1925; Prospect Peak at 7500 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet.

A male from the western part of the section in December weighed 33.2 grams. One from the eastern end of the section in January weighed 34.5 grams. An adult male, June 29, weighed 33.7 grams. Adult females collected in June and October weighed 32.1 and 50 grams (the latter commented upon by the collector as ''excessively fat''). A young bird just out of a nest, bob-tailed, on June 17, 1924, weighed 33.2 grams.

Solitaires were seen most often on sloping ground in the more open portions of the coniferous forest. Single birds or pairs perched at the tips of trees, in bushes, or on the ground. Singing perches were usually high in conifers. Foraging and nesting activities, however, took place on or near the ground, often among logs, about the bases of trees, or along cut banks.

In mid-July, 1924, a solitaire was observed at Lake Helen, fly-catching over the water in a manner almost like that of a swallow. In the proper season, wild fruits formed an important portion of the food of this bird. On July 26 and August 3, 1925, solitaires were observed near Mineral feeding on the fruits of the service-berry. In the vicinity of Termo in mid-October, 1924, these birds were eating juniper berries, chiefly where fallen on the ground. Individuals that were collected there were excessively fat.

Four solitaires observed close to Mineral on May 20, 1927, were spaced out along the cut banks of roads along mountain sides and were thought to be prospecting for nest sites. A foraging individual at Butte Lake, June 27, 1928, kept carrying the results of its foraging from the water's edge back up a hillside, probably to a nest with young.

Near Mineral a solitaire's nest was found on June 22, 1925. It was at ground level inside a burned-out cavity at the base of a living sugar pine whose trunk was three-fourths of a meter in diameter. The nest was in-set in the bark and needle floor, right against the charcoal wall at the back. The rim of the nest on the exposed side was marked by coarse pine twigs and needles, scattering out on the floor toward the opening of the cavity. The rim stood about twenty-five millimeters higher than the ground in front. The nest was found by watching the old birds, with food, perching around quietly on stubs of fallen logs and on lower branches of big standing trees, finally flying down to the site. The yellow thickened corners of the mouth and edges of the bill loomed up in the shade of the cavity as a most conspicuous feature of each of the four young birds. The location was on a dry ridge top in an open forest of white fir, incense cedar, yellow pine, and sugar pine.

Another nest was found, July 15, 1924, close to Lake Helen. This one was in a nook (20 by 20 centimeters) formed by three rocks on a dry, rocky ridge. The cavity had a little dry moss in the back part of it and a spray of grass at the entrance. A few hemlocks stood above and below the site on the slope, but none was nearer than fifty meters. The nest, composed of sticks and twigs, was lined with needles from silver pine. In the nest were two small young birds and an infertile egg. Both parents came and perched in the hemlocks and one flew to the nest and hovered the young.

Townsend (1887, p. 231) records that he found a nest containing three eggs on July 12, 1884, "in the dense pine forest surrounding Butte Lake. . . . . It was built in a cavity in the splintered end of a pine log, which, having fallen across a boulder, was raised about 5 feet above the ground. . . . . A projecting piece of bark sheltered it perfectly."

Sheldon (1907, p. 191) records the presence of this bird at or near the southwest end of Eagle Lake in the summer of 1905. A nest was found near Pappoose Valley.

Polioptila caerulea amoenissima Grinnell

Western Blue-gray Gnatcatcher

A summer visitant on the western slope of the section below 3300 feet altitude. A single specimen was obtained at Dale's, 600 feet. Observed at the following additional places: ten miles north of Red Bluff, 500 feet; six miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Mill Creek, 260 feet; Elliott's, 1000 feet; Manton, 2300 feet; Lyman's, 3300 feet.

A female shot May 20 weighed 5.8 grams.

Willow, valley oak, manzanita, digger pine, blue oak, and buckbrush are all plants in which individual gnatcatchers were seen. However, the portion of the section most favorable for this bird, as indicated by concentration of breeding birds to cover practically the whole of such area, was the tract of blue-oak-covered hills north of Red Bluff and west of the Sacramento River (fig. 54). There the park-like arrangement of the trees, each with many slender branches covered with copious foliage, and with the intervening spaces between the trees of a uniformly short distance, seemed ideally to fulfill the requirements of this bird for nesting and foraging activities. The amount of rainfall and the gravelly nature of the soil compared with corresponding factors in the hills east of the river seemed important in maintaining this habitat at a stage so well suited to the needs of this one species of bird. Thus, those two factors might be considered as controlling, indirectly through their influence upon the vegetation, in the Lassen section, the density of the population of the gnatcatchers.

In the spring of 1928, gnatcatchers were first observed, six miles north of Red Bluff, on April 5; but they had doubtless arrived there some days previously. The birds were then in pairs, singing and feeding in the tops of blue oaks; seemingly, most of them had not yet started nesting.

On April 8 three pairs of gnatcatchers were observed building nests, all within a distance of one-fourth mile, along a blue-oak-covered ridge. One nest was three and one-half meters up in an upright crotch in the midst of the crown of a small blue oak. Both birds were working rapidly, carrying material to the site. On April 15 no trace of this nest could be found, although the observer felt sure he had relocated the site. Possibly the birds had removed the material to build a nest in another place. A pair was noted whose interest seemed centered in a close-by clump of trees.

Just after noon two birds were watched working at a nest close to, and in a situation almost exactly like, the one found first, except for being one-half meter higher from the ground. Sometimes one bird stayed on the nest while its mate made two or three consecutive trips after material which the first bird arranged. On April 15 this nest had been completed but it was empty. The lining was of feathers and the outside was plated with bits of flat lichen uniform in size. Most of the gnatcatchers seen on that day were in pairs, so that it seemed evident that incubation had not yet started.

The third nest was on a limb slanting at a forty-five degree angle and was ten meters above the ground in the top of a large blue oak. In mid-afternoon the two birds were working persistently, and calling, while at the same hour most other kinds of birds were quiet. Another pair of this species was calling in trees thirty meters away from this nest.

On April 9 at ten miles north of Red Bluff, two gnatcatchers were carrying material and adding it to a nest six meters above the ground in a crotch in the main stem of a small blue oak.

At Silva's on April 13 two birds were observed constructing a nest twelve meters up on a horizontal limb of a sycamore. The tree was not then completely leafed out, so that at that time the nest was not entirely shaded. One of the birds speedily flew after and routed a house wren from the lower part of the nest tree.

The hills north of Red Bluff were visited again on April 23. One empty nest, apparently completed, was seen five meters above the ground and in a crotch made by a limb sloping at a thirty-degree angle with the horizontal and a vertical limb. An adult gnatcatcher was calling in a near-by tree. Birds were seen near, but not on, another nest, six meters up and at the edge of the crown of a blue oak. The contents, if any, were not determined (Linsdale, MS).

Regulus satrapa olivaceus Baird

Western Golden-crowned Kinglet

Present in summer, only in the higher, mountainous part of the section, above 4800 feet altitude. Found in winter at least from about 5000 feet down on the western slope nearly to the Sacramento River. Specimens were preserved from the following localities: Dale's, 600 feet, December 22, 1924; Inskip Hill at 1800 feet, December 23, 1927; eleven miles east of Payne Creek P. O., 3500 feet, December 21, 1927; Mineral, 4900 feet, December 20, 1927, and observed through the summer; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Willow Lake, 5600 feet. Observed also at the following additional localities: Manzanita Lake, 6000 feet; Lake Helen, 8200 feet.

Sheldon (1907, p. 191) records that he found this kinglet in the summer of 1905 "fairly common" at the southwest end of Eagle Lake. A specimen was taken.

This kinglet in summer was seen most often in young fir trees. Once, at Manzanita Lake, some individuals were observed in willows bordering a stream. In winter the species was observed in small flocks that frequented such trees as white fir, incense cedar, yellow pine, and valley oak.

On Battle Creek Meadows after sundown on December 20, 1927, a band of eight or more golden-crowned kinglets was observed among bare-stemmed willow clumps and small dense yellow pines. Some of the birds foraged on the bare ground back under the pines and among the basal tangles of the willow thickets. Under the pines it was so dusky the observer could hardly see the birds, and yet they were actively searching for, and evidently finding, minute objects of food value.

On several occasions in winter at lower levels this species was seen in mixed flocks with bush-tits.

On June 24, 1924, an observer at Summit Creek watched a kinglet fluttering in the air and pulling at an object thirteen meters above the ground in a white fir tree. Finally the object fell to the ground, whereupon it proved to be an old nest containing the remains of one egg. The bird was evidently taking materials to add to a new nest. Later, a kinglet in the same tree was observed to settle on a nest where it remained. This new nest was well concealed in a mass of branchlets near the end of a bough ten meters up in the tree.

Near Mineral, in 1925, groups of young golden-crowned kinglets just out of nests were found on June 22 and 28. An adult was seen carrying a caterpillar, apparently for young, near Manzanita Lake on June 11, 1926.

Corthylio calendula cineraceus (Grinnell)

Western Ruby-crowned Kinglet

Present in summer in the higher, mountainous portion of the section down to about 4800 feet altitude; in winter found in the lower western part of the section. Specimens represent the following localities: six miles north of Red Bluff, 500 feet, January; Dale's, 600 feet, December; Payne Creek P. O., 1600 feet, December; Inskip Hill at 1800 feet, December; Manzanita Lake, 6000 feet, June 12, 1926. The species was observed, but not collected, at the following stations: six to ten miles north of Red Bluff, 500 feet, December, January and April (up to the 15th); Cone's, 270 feet, December, April 6; Turner's, 3500 feet, April 26; Turner Mountain at 6000 feet, July; Battle Creek Meadows, 4800 feet, all summer; Mineral, 4800 feet, all summer (earliest, April 19, 1929); west side of Broke-off Mountain at 8000 feet, June; two miles west of Black Butte, 6800 feet, June and July; Wilson Lake, 5100 feet, May; Kelly's, 5200 feet, September 2 to 4, 1925; Prospect Peak up to 8000 feet, June 28; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; ridge south of Eagle Lake, 5800 feet.

Sheldon (1907, p. 191) records a specimen taken in the summer of 1905 somewhere near Pappoose Valley, south of Eagle Lake.

Weights of five males collected in the western part of the section in midwinter were 5.7, 6.4, 6.8, 7.2, and 8.1 grams. A male from Manzanita Lake, June, weighed 6.1 grams.

During the winter, ruby-crowned kinglets foraged among the branches and foliage of tall shrubs and trees. Individuals were observed, at that season, about the following kinds of plants: digger pine, yellow pine, live oak, blue oak, buck-brush, clumps of mistletoe in cottonwood, willow, and cat-tail. Almost any sort of twiggery, whether leafy or not, where small insects might be found seemed to be a suitable winter forage place.

On December 30, 1927, several kinglets were observed feeding in the foliage of live oaks along Antelope Creek. Occasionally one would fly into the air after insects, and one individual was watched moving over the ground for several minutes, apparently in search of food. On December 22, 1924, a kinglet was watched exploring, wren-fashion, back under a buck-brush bush among the stems there. Apparently almost any bird, hungry, will go well out of its usual forage niche to seek food—perhaps by trial and error method.

In the summer when the kinglets were in the mountains they lived among the tops of coniferous trees, especially white fir, lodgepole pine, red fir, and hemlock. On June 14, 1925, a kinglet was watched as it foraged about the ends of the branches close to the summit of a fir fully fifty meters tall. Every now and then the bird sang, without stopping in its fluttering, zigzag course. Presently it flew to an equally tall dead fir nearby and perched at the tip of an outermost dead twig for fully five minutes without changing its location, at intervals giving its song. The bird would change position only to the extent of swinging the axis of its body about 45 degrees, now and then—thus "looking" in another direction. The bird was a male, probably in position to overlook its nesting domain, for within thirty meters was the focus of an alarm "dirge" of a pair that had been watched there previously.

A nest was found near Mineral on June 14, 1925. It was out on a bough of a young white fir 96 centimeters from the bole of the tree and 88 centimeters in from the extreme end of the bough. The rim was 518 centimeters above the ground. The site was a flat mass of "bough," stem with live twigs and needles beneath. The bough, slightly drooping, extended out to the southwest, sunny exposure, from the stem of the tree which was one of a clump of twenty-five or more fir trees (fig. 67) ranging in height up to over fifteen meters.

The nest was discovered by tracing a female kinglet that had been foraging in the shade close to the ground in the lower branches of firs, as it went to the nest site and tarried for a moment. Subsequently, the nest was examined several times, but was found to be empty. When it was removed on June 28 it showed evidences of having contained young. It was thought that this kinglet family was just leaving this nest when it was first seen on June 14.

On June 19, 1925, a pair of kinglets was observed vigorously assaulting a Steller jay in the top of a fir tree.

The six specimens obtained, winter- and summer-taken ones alike, all show the characters of *Corthylio calendula cineraceus* rather than those of *C. c. calendula* or *C. c. grinnelli.*

Anthus spinoletta rubescens (Tunstall)

American Water Pipit

Present in the western portion of the section in winter, and in other portions as a transient. Specimens were collected at the following places: ten miles north of Red Bluff, 500 feet, January 1, 1928 (also observed April 9 and 10); Coyote Creek, 270 feet, December 28, 1927; Dale's, 600 feet, December 21, 1924; five miles north of Fredonyer Peak, 5700 feet, October 5, 1924. Observed, but not collected, at the following additional places: Sisson's, 280 feet, April 20, 1911; Cone's, 270 feet, December 29, 1927; two miles north of Dale's, 700 feet, April 22, 1928; Lassen Peak at "very top," 10,451 feet, one seen September 11, 1923 (Dixon, MS); Spalding's, 5200 feet, October 12, 1923.

Two males and a female collected in midwinter weighed 18.8, 19.7, and 20.9 grams, respectively. A female, young-of-the-year, October 5, weighed 20 grams.

Pipits were observed feeding in winter in the western part of the section in such situations as the following: in alfalfa fields; in freshly plowed fields; on a seepage slope among rocks; at pebbly edge of small stream on prairie; among rocks at edge of large rain pools; around edges of small rain pools on prairies.

Although this bird was seen most frequently in small companies, solitary individuals were recorded, as also, in midwinter, flocks of considerable size.

Bombycilla cedrorum Vieillot

Cedar Waxwing

Found by us irregularly in winter and early summer (but not breeding) in the western part of the section. One specimen obtained on Inskip Hill at 1800 feet, December 22, 1927. Observed at the following additional localities: six miles north of Red Bluff, 500 feet, April 8, 1928; Red Bluff, 300 feet, May 8 and 13, 1924; Tehama, 260 feet, December 28, 1927; Manton, 2300 feet, April 19, 1928, and June 3 and 4, 1926.

The single bird collected, a male, weighed 34.1 grams.

In the neighborhood of the Sacramento River the cedar waxwing chose as perches the tops of sycamores, willows, and valley oaks. In December, a flock of seven was feeding on mistletoe berries in a cottonwood tree. The individuals in a flock of about twelve seen in early April were feeding in the tops of blue oaks and flying out into the air between the trees after insects. At Manton, on two days in June, a single bird was seen in cherry trees where it was thought to be after the then ripe cherries.

Townsend (1887, p. 222) found a "flock of about a dozen" at Red Bluff, December 19, 1883.

Phainopepla nitens lepida Van Tyne

Northern Phainopepla

But a single phainopepla was seen in the section: an individual in flight near Mill Creek, 260 feet, on June 8, 1912 (W. P. Taylor, MS).

Lanius borealis invictus Grinnell

Northwestern Boreal Shrike

In the California Academy of Sciences is a specimen (no. 4271, coll. J. and J. W. Mailliard) taken by J. M. Willard at or near Eagle Lake, November 26, 1899. The plumage is heavily washed with brown and the wing and tail feathers are dark brown rather than black, indicating a bird-of-the-year.

Lanius ludovicianus gambeli Ridgway

California Loggerhead Shrike

A resident in the western end of the section. Present also eastward from Eagle Lake, but probably in summer only (fig. 94). Specimens represent the following localities: ten miles north of Red Bluff, 500 feet; Coyote Creek, 270 feet; Cone's, 270 feet; Dale's, 600 feet; sage flat near southwest end of Eagle Lake, 5200 feet, May 16 and 27, 1925; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet; Box Springs, 5300 feet. Observed also at nine miles southeast of Red Bluff, 270 feet, and at Mill Creek, 260 feet.

Weights, in grams, of birds from the western part of the section were as follows: two females, December, adult, 45.6, first-year, 48.6; an adult male, January, 44.7; a male, first-year, May 6, 47; a young male, May 22, 45.8. Two first-year females from the vicinity of Eagle Lake in May weighed 43 and 44 grams. Weights of three full-fledged young birds taken in July in the eastern end of the section were: 42.9, 43, 43.5; an adult male of same data, 45.9.

In the western part of the section shrikes were most often seen in the tops of small blue oaks, especially in the ones that grew in open places where the view of surrounding ground would be unobstructed. Others were seen in the fringes of bushes along prairie streams, and a few were observed on poles or posts at roadsides. In the eastern part of the section the birds used the following types of perches, around which they foraged: tips of living or dead juniper trees; tops of sagebushes; tops of clumps of wild rye; fence posts; telephone poles and the wires strung between them.

One individual habitually perched on a telephone wire and close to (within 15 centimeters of) a certain pole that the observer watched. When a hawk approached or when automobiles passed by on the road this bird quickly flew down to cover near the ground. This perch was used more in early morning and late afternoon than during the hot mid-day hours when observations were made in late July. During the hotter hours of the day several individuals were observed on the ground in the shade of fence posts. It was evident that at those times the heat in the unobstructed sunshine was great enough to make the birds sufficiently uncomfortable so that they sought shelter.

Near the camp at Red Rock P. O., a shovel was left standing with its handle in an upright position. This provided a perch slightly higher than the surrounding bushes. Immediately, some young shrikes showed a preference for this shovel handle as a perch and it was occupied much of the time for the few days it was left there (Linsdale, MS).

A shrike that was observed, May 16, 1925, catching grasshoppers near Eagle Lake was shot and its stomach was examined. The observation was verified, for it was found that the bird had eaten these insects. A grasshopper was found, June 19, 1928, near Red Rock P. O., impaled one meter above the ground on a dead twig of a sagebush close to where birds of this species were observed. In that vicinity on July 23, 1928, a shrike was observed repeatedly to fly into the air as if after flying insects.

On April 9, 1928, a nesting pair of shrikes was found settled near the belt of mergence of the rolling prairie and the timber-covered hills ten miles north of Red Bluff. The nest was located three and one-half meters above the ground in the top of a clump of manzanita growing where trees were scattered. The basal portion of the nest and its main structure were of sticks with a few bunches of wool scattered among them. The lining was chiefly of sheep's wool. The nest was empty but apparently it was completed or nearly so. Both birds of the pair were present, but they were not especially demonstrative. Both were seen at the nest. While the observer was near, the birds spent most of their time on or close to the tops of some of the many blue oaks in the neighborhood. One bird, on the tip of a tree when the other came near, spread its wings, fluttered them, and uttered a continuous screechy call.

At the edge of the floor of Petes Valley a nest was found on June 8, 1929. It was in a small juniper slightly over two meters tall from which sheep had browsed the foliage to a height of 97 cm. so that one could see clearly through the branches which were given off down clear to the base of the tree. The nest rim was 88 cm. above the ground, the structure being supported where the main stem divided and gave off branches. The huge nest was 25 cm. across and 22 cm. deep, outside dimensions. It was built mostly of sage twigs and the deep cavity was lined with sheep's wool. Four young were in the nest, nearly naked and with eyes still closed. One parent was close about, alighting on sage tips 13 to 20 meters away. This bird, probably the female, was fed several times within five minutes by the shy parent. The male (?) would go to the ground and get something, probably the small grasshoppers that were all about, and carry it to the mate, which would come down or across the branches a little way to meet him, at the same time shivering the wings and uttering "wheedling" notes.

A nest was found June 17, 1929, at the edge of a meadow seven miles south of Ravendale. The site was three-fourths of a meter up in the center of a clump of antelope brush. The seven young were just ready to leave the nest. Three of them were perched out in the periphery of the bush. Their tail feathers were close to 25 mm. long. Both adults were carrying food to the young. The nest rim was flattened and pushed down to a mere platform.

Two young were shot, July 12, 1928, from perches in the tops of dead or dying junipers on the slope west of Petes Valley. A nest that had been occupied recently was found in a near-by juniper. It was made of straws and dead sticks and was lined with sheep's wool.

Observations made in the eastern part of the section in the last half of July, when many family groups of shrikes were seen, demonstrated that the parents and young stay together for several weeks after leaving the nest. The adults, much more wary than the young, invariably kept at a good distance from human intruders. It is likely, also, that nesting of this species is later seasonally in the eastern than in the western part of the section.

Examination of our series of shrikes from the Lassen section discloses to us no differences as existing between east-end and west-end birds, nor between the latter and specimens from farther south in the Sacramento-San Joaquin valley.

Vireo bellii pusillus Coues

Least Bell Vireo

A summer visitant to the immediate vicinity of the Sacramento River, and up the tributaries of that stream to at least as high as 600 feet altitude. Specimens were obtained at Blue Tent Creek, 350 feet; Red Bluff, 300 feet; Dale's, 600 feet. Also observed, but not collected, at Bloody Island, 350 feet, Tehama, 250 feet, and Mill Creek, 260 feet.

Weights of seven adult males collected in May were: 8.2, 9.2, 9.2, 9.2, 9.5, 10, and 13 grams. Two adult females in May weighed 10 and 10.8 grams.

The least vireo was observed in the vicinity of Red Bluff as early as April 7, 1928. It lived for the most part near the ground in stream-side willow thickets. Individual birds were seen also to forage into grapevine tangles, valley oaks, and live oaks. During a boat trip from Red Bluff to Tehama, May 13 and 14, 1924, this bird figured prominently in all the censuses taken, not only because of its evident choice of the willowy margins of the river, and its numbers, but also by reason of the persistency of its singing at that season.

The closest avian associate of the least vireo was the yellow warbler. For example, a mid-river island in the Sacramento two miles or so above Red Bluff, and comprising about ten acres, harbored on May 7 three singing male vireos and eight singing male warblers. But in foraging, the vireos kept near the ground, below about the 3-foot level, while the warblers kept mostly above that level.

On April 23, 1928, seven miles north of Red Bluff, a pair of vireos was watched for several minutes. The birds were in willows and sparse brush along a small stream in the hills. One, probably the male, was singing and keeping within one meter of the other, both moving through the low branches, feeding. The singing bird kept its tail spread and frequently gave it a twitch, spreading the feathers still more. Also at intervals the tail was pushed downward to a nearly vertical position.

At Dale's on May 23, 1924, a female was shot that had not yet laid, but which contained developing ova. The nest found near-by was two meters up in a slender, forking willow stem, under a canopy of taller willows and over water. The structure was not yet quite completed.

Our series of nine least vireos from within the Lassen section marks the northernmost station so far recorded for this subspecies. Scrutiny of this series shows an average greater wing length as compared with material from southern California and northern Lower California. The average and extreme wing-lengths, in millimeters, of our birds are: 55.4 (52.9–57.4); the smallest is a female (two of this sex in the series), the largest a male.

Vireo solitarius cassinii Xantus

Cassin Solitary Vireo

Found by us in spring and summer at most of the localities in the section eastward as far as Eagle Lake. Specimens represent the following localities: Blue Tent Creek, 350 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Lyman's, 3300 feet; near Mineral at 4900 and 5500 feet. Observed also at the following additional localities: Elliott's, 1000 feet, April 14, 1928; Payne Creek P. O., 1600 feet; Manton, 2300 feet, April 18, 1928; Turner's 3500 feet, April 26, 1928; Battle Creek Meadows, 4800 feet; two miles west of Black Butte, 6800 feet; Broke-off Mountain at 7500 feet, July 27, 1925; Manzanita Lake, 6000 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet, September 2, 1925; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet.

Weights of four adult males from the western part of the section, taken in May and June, were: 11.7, 13.2, 14, and 14.4 grams. Two adult females from near Mineral, in June and July, weighed 15.5 and 14.9 grams, respectively.

The metropolis of the Cassin vireo in its breeding season was found to lie at the middle altitudes on the western slope of the section. Here, for example in the neighborhood of Mineral, intimate association was shown with the incense cedar, even though this tree never grew in pure stand but in minority among such other trees as yellow pine, sugar pine, black oak, and white fir. To the westward, in the vicinity of Turner's and Inskip Hill, individuals, undoubtedly on their breeding ground, were seen in yellow pines and black oaks. Scattering pairs were thought to be nesting still lower to the westward, at Dale's and even near Bloody Island and near the mouth of Mill Creek. At these places, the birds frequented blue oaks and valley oaks. During April and early May, when many individuals were noted in the lower, western end of the section, evidently in migration, they were seen to frequent blue oaks and live oaks. In late summer, July 27, full-grown birds-of-the-year were seen highest in the mountains, 7500 feet, foraging in thickets of white alder.

Near Mineral on June 22, 1925, a nest of this vireo was found on a dry ridge top. The nest was 1.9 meters up and 1.7 meters out to the south from the main trunk of an incense cedar and was over the open forest floor. The tree was small, trunk 20 centimeters in diameter, and was growing beneath a sugar pine and a white fir. The female was brooding closely, while the male was singing overhead. Incubation was well started in the four eggs.

Another nest was found near Mineral, located near the end of a drooping incense cedar branch 1.7 meters above the ground and 2 meters out from the tree trunk on the south side of the tree. The tree, close to half a meter in trunk diameter, stood ten meters from the edge of a willow bog and a shorter distance from a thick stand of firs on the other side. The nest was found partly built on June 15, empty but seemingly completed on June 20, and with four fresh or nearly fresh eggs, and the male incubating, on June 27. After being 'frightened from the nest the male sang for a while, then went away. After an interval of twenty minutes the female came quietly to the site.

Vireo gilvus swainsonii Baird

Western Warbling Vireo

Widely distributed in summer over the section below 7000 feet altitude. Specimens represent the following localities: Red Bluff, 300 feet; Bloody Island, 350 feet; Dale's, 600 feet; Manton, 2300 feet (observed April 20, 1928); near Mineral at 5600 feet; two miles west of Black Butte, 6800 feet; five miles north of Fredonyer Peak, 5700 feet. Observed also at the following additional localities: Silva's, 270 feet, April 12, 1928; Cone's, 270 feet, April 6, 1928; Mill Creek, 260 feet, June, 1912; Antelope Creek, 300 feet; Elliott's, 1000 feet, April 14, 1928; Payne Creek P. O., 1600 feet, April 22, 1928; Manzanita Lake, 6000 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Gallatin's, 5200 feet; Jones', 5400 feet, July 24, 1928.

Two adult males collected in May at the western end of the section weighed 11.5 and 12.4 grams. Two females of same data weighed 10.6 and 12.9 grams. A partly fledged young bird, male, just leaving its nest at Dale's, on May 29, weighed 8 grams. Two adult males from two miles west of Black Butte in midsummer weighed 11 and 12.2 grams. An adult female from near Mineral, July 5, weighed 13.7 grams. A young female from five miles north of Fredonyer Peak, October 1, 1924, weighed 13.1 grams.

This vireo showed preference for deciduous trees and for the ones that grew in moist places, bordering streams or on seepy ground. Probably the growth-form of the trees in those situations, since it was uniformly of a type that would furnish nesting sites and singing perches at a medium height from the ground, provided the feature of that habitat which determined the presence of the birds there. It seems then that the moist nature of the habitat is of only secondary importance, influencing the vegetation but in itself having little or no importance for the birds of this species.

Along Summit Creek where there was a deep, dark ravine, individuals of this vireo were observed to go from the stream-side alders, early in the morning, to the tops of near-by tall firs and sing there in the sunshine.

In the higher mountains, singing warbling vireos were found in May on their nesting grounds in the willows and white alders when those trees were yet leafless. However, there were catkins, and possibly insects, on the alders. At Butte Lake, June 15 to 27, one or more pairs were established in the grove of aspens at the west end of the lake.

On June 15, 1925, near Mineral, attention was directed to a vireo's nest by a volubly singing bird. The nest was six meters up and two meters out from the trunk of a cottonwood which towered above the level of the willow thickets at the side of a division of Battle Creek.

The site in a forking twig near the end of a drooping branch was assured shade by a heavy canopy of large leaves on a branch just above it. The bird's tail projected well beyond the nest rim, and was depressed with the rhythm of the singing, and the bird's mandibles opened widely with the fullest-toned utterances.

On the trail from Mineral toward Broke-off Mountain at 5600 feet a nest of this species was found, July 5, 1925, at the willowy edge of a cienaga. The nest was nearly four meters up in a spindling willow in the shade of firs and a sugar pine. The nest was found by tracing up a singing bird which was sitting. This bird shortly left and was replaced by its mate, a female, which was shot after it flew to a willow. The oviduct of the female contained a fully grown egg, without shell, that probably would have been added to the three in the nest.

At Dale's, on May 28, 1924, a lone young warbling vireo, out of its nest, but with its feathers not yet fully grown, was picked up on the ground. Evidently the vireos in the lower part of the section nest earlier by even as much as eight weeks than the ones highest in the mountains. However, it is possible that the July record for the beginning of nesting is an especially late one.

On June 12, 1929, a warbling vireo was heard singing in the lower part of a pine tree at the edge of Eagle Lake near Eagle Lake Resort. Acting on the assumption that a nest must be near and that it would likely be in a deciduous tree, the observer began looking for that type of tree. A glance up-slope showed a clump of willow, five meters high, the only tall deciduous plant in sight. On the opposite side of the clump was found a nest, two and one-half meters up, hanging from the end of one of the shoots. The nest contained one egg. The singing bird, twenty meters away, was the only vireo in sight.

Vermivora ruficapilla gutturalis (Ridgway)

Calaveras Nashville Warbler

Found as a transient in the western part of the section and as a summer visitant, breeding, from 3300 to 7000 feet altitude westward from the vicinity of Eagle Lake. Specimens were obtained at the following places: Red Bluff, 300 feet, May 7, 1924; Tuscan Springs, 1200 feet, April 22, 1911; Lyman's, 3300 feet, June 9, 1924; Turner's, 3500 feet, April 27, 1928; ridge at 5500 feet, two miles northeast of Mineral, July 29, 1925; ridge at 7000 feet, five miles northeast of Mineral, June 30, 1925; Broke-off Mountain at 9200 feet, July 27, 1925. Observed also at the following additional localities: Manton, 2300 feet, April 21, 1928, and May 30, 1926; Manzanita Lake, 6000 feet, June 5, 1926; Summit Creek, 5200 feet, June 17, 1924; two miles west of Black Butte, 6800 feet, July 7, 1924;

Kelly's, 5200 feet, September 3, 1925; Butte Lake, 6100 feet, June 16 to 20, 1926; ridge south of Eagle Lake, 5800 feet, June 14, 1929.

Weights of two males in midsummer were (bird-of-the-year) 8.1 and (adult) 8.3 grams. Weights of three females were: 8.3, 8.3, and 8.6 grams (first one adult, last two full grown birds-of-the-year).

The following examples typify the situations in which this warbler was found in late June. Near Mineral two were singing in the vicinity of some smallish black oaks on a dry ridge, but singing from all sorts of places up to twenty-five meters above the ground in firs and cedars. A male was shot at 7000 feet altitude from the topmost dead twig in a clump of dwarfed Sierra maple surrounded by tobacco brush and chinquapin. Red firs and lodgepole pines were the near-by trees. This was our highest record, altitudinally and zonally, for a breeding bird. On another, lower, ridge the observer was almost sure to find this species in the vicinity of the black oaks which occurred scatteringly among pines and white firs, or amid chaparral of snow-brush and red-cherry.

Adults were seen on June 14, 1924, feeding young just out of the nest near Lyman's. Singing males were heard there on the same day.

Near the summit of Broke-off Mountain, on July 27, 1925, a company of six or eight Calaveras warblers was seen in dense hemlocks, through which they were moving restlessly. The one shot was a full-plumaged (first annual) young-of-the-year, showing that post-breeding dissemination of this species was already under way, carrying individuals in this instance far above the nesting range.

Vermivora celata lutescens (Ridgway)

Lutescent Orange-crowned Warbler

Summer visitant, though scatteringly, in the western portion of the section; easternmost known locality of occurrence, Bogard Ranger Station. Specimens were obtained at the following places: ten miles north of Red Bluff, 500 feet, April 10, 1928; Antelope Creek at seven miles southeast of Red Bluff, 350 feet, April 11, 1928; ridge three miles northeast of Mineral, 7000 feet, June 26, 1925; two miles west of Black Butte, 6800 feet, June 27, 1924. A specimen in the collection of the California Academy of Sciences, no. 26326, was collected at Bogard Ranger Station, 5500 feet, September 10, 1923. This species was recorded by observation only, at the following additional localities: six miles north of Red Bluff, 500 feet, April 5, 1928 (earliest date in the section); Silva's, 270 feet, April 13, 1928; Cone's, 270 feet, April 17, 1929, April 24, 1928; Elliott's, 1000 feet, April 14, 1928; Inskip Hill at 1800 feet, June 12, 1925; two miles southwest of Lyman's, at 2800 feet, May 26, 1927; Manton, 2300 feet, April 19 and 21, 1928; Manzanita Lake, 6000 feet, June; Mineral, June 19, 1927; between Soupan Springs and Lake Helen, at about 7500 feet, August 1, 1925; Kelly's, 5200 feet, September 3, 1925.

An adult male in April weighed 9 grams. Two fully fledged young females taken the latter part of June in the mountainous part of the section weighed 7 and 7.8 grams.

Situations in which individuals of this warbler were observed are as follows: in top of blue oak; in top of large valley oak; in scrub oak; in lower branches of blue oak; in brush at edge of stream; in white alders; in top of lodgepole pine.

On June 7, 1926, an orange-crowned warbler was observed gathering nesting material from the ground among bushes on the chaparral-covered slope south of Manzanita Lake. The earliest date for young out of the nest was June 19, 1927, at Mineral, but this bird was full-grown and likely not reared in the immediate neighborhood.

Sheldon (1907, p. 190) reports the "breeding" of this warbler at Eagle Lake in 1905, but gives no details.

Dendroica aestiva brewsteri Grinnell

California Yellow Warbler

Summer visitant in suitable habitat from one end of the section to the other; most plentiful toward the west. Specimens represent the following localities: Red Bluff, 300 feet; Bloody Island, 350 feet; Dale's, 600 feet; Manton, 2300 feet; Mineral, 4900 feet; Willow Lake, 5600 feet; Jones', 5400 feet. Also observed at the following places: Tehama, 250 feet; Cone's, 270 feet; Mill Creek, 260 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Wilson Lake, 5100 feet; Bogard R. S., 5500 feet; north end of Eagle Lake, 5200 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet.

Weights of nine adult males averaged 9.3 (8.1 to 11) grams. Three adult females weighed 9.5, 10.4, and 11.1 grams. A young female and a young male taken in late July weighed 5.7 and 6.6 grams, respectively.

Foraging or singing individuals of this warbler were noted in the following kinds of plants, here named about in the order of frequency: willow, alder, sycamore, aspen, snow-brush, chinquapin, mountain mahogany, valley oak, blue oak, grape vine, yellow pine, white fir, and wax-berry. Some of these plants were frequented only during the seasons of migration; at those seasons this species appeared to forage over a much wider range of situations than during the period of nesting in summer. This bird appeared to be suited to forage, in summer, in the foliage of the upper stratum of shrubby plants of low stature. In the lower western and the eastern parts of the section these conditions seemed to be best satisfied in the stream-side fringes of willows. On an island of some ten acres extent, in the Sacramento River two miles above Red Bluff, on May 7, 1924, eight singing males were found established, well spaced out, each, of course, representing a breeding pair. This island was clothed with an almost uninterrupted jungle of willows.

However, at some of the higher places, as around Mineral, the birds found, in addition, satisfactory surroundings in the extensive growths of snow-brush. There they were able to live in places away from water.

The accounts of nests that now follow indicate that the sites chosen are usually in the same stratum as the one where most of the foraging is done. Crotches of small branches into which nests may be saddled securely are plentiful at that height in shrubs.

At the side of a creek near Lyman's a yellow warbler's nest was found on June 10, 1924. When first found there were three eggs in the nest and, as none had been added when the site was visited four days later, this was thought to be the full set. The nest was one meter above the ground in a bush of wax-berry (*Symphoricarpos*). The surrounding vegetation was willow, wild cherry, and wild rose. The brooding bird would stay on the nest until approached to within one meter; then it would slip off and sneak away through the brush. If the intruder stopped at the nest the bird would return and scold.

On June 16, 1927, a nest containing three fresh eggs was found two meters up in a willow crotch in a jungle of willows on Battle Creek Meadows. On June 19, a nest, rim 102 centimeters above the ground, containing four far incubated eggs, was found in an upright crotch of snow-brush. The site was a cluster of blossoming branches in a great mass of bushes on a slope adjacent to the meadow.

Near Mineral on June 19, 1925, a nest was found, rim 128 centimeters above the ground, in a nearly upright three-forking stem of snow-brush on a south-facing dry slope covered with that plant. The near-by trees were white firs and yellow pines. The nest was rather conspicuous, near the top of the tallest spray in the vicinity and 45 centimeters below the uppermost leafage, directly above. The four eggs appeared to be far incubated. The female went through the brush all about the observer, "tsipping" anxiously. The male was also, then, in the bushes, although previously it had been seen often, singing from the pines and small firs.

Another nest found the same day was close to two and one-half meters above the ground, saddled on crossing stems in the midst of a willow thicket on Battle Creek Meadows. This one contained two fresh eggs.

On June 20 a nest was found, rim 158 centimeters above the ground, in a dense willow thicket of a creek bottom near Mineral. This one was insecurely fastened to several slender willow twigs which happened to pass each other at the chosen point. It seemed to the observer that a very moderate breeze would have dislodged this nest. The site was about two meters from the creek which there ran in a deep channel beneath the interlacing willow tangle. The four eggs appeared to be about half incubated. When the observer was near, the female "tsipped" about solicitously, while the male sang in the neighboring willow tops.

Close to the creek in Secret Valley a nest of the yellow warbler was found on June 15, 1929. It was one meter above the ground in a rose vine and contained four eggs. On the next day a nest was seen, its rim 96 centimeters above the ground, fastened between stems of rose and willow and at the edge of a clump of rose. Tall grass and willows were growing near by. Inside diameter of the nest at the rim was 45 mm.; inside depth, 35 mm.; greatest height, 80 mm. Most of the lining of cottony material was added to this nest during the day it was found. Also a few black horsehairs were placed near the rim. Rose leaflets directly above the nest provided shade. The site was 25 meters from the stream.

On June 21, 1929, at Bogard R. S., a nest was seen two meters up in the center of a clump of willow on the meadow. The nest was fastened to upright stems. The nearest other clump of willows was ten meters away. One hundred meters away was a dense grove of lodgepole pines. In the nest were four just-hatched young. Both parents were about and mildly solicitous.

Dendroica coronata hooveri McGregor

Alaska Myrtle Warbler

A male, shot from a valley oak at Red Bluff, 300 feet, May 3, 1924, constitutes our only record of the occurrence of this species within the section. This bird (no. 45448) weighed 13 grams. Its throat shows centrally a slight infusion of yellow; but no other feature of the entire specimen shows further suggestion of possible hybridity with *Dendroica auduboni*.

Townsend (1887, p. 223, and MS) found this warbler "plentiful in the timber belts" at Red Bluff in the late spring of 1884, and took four specimens on May 1.

Dendroica auduboni auduboni (J. K. Townsend)

Pacific Audubon Warbler

Found in summer in the mountainous portion of the section, from Lyman's eastward to Spalding's, on Eagle Lake; also as a transient and winter visitant in the lower western portion. Collected at Lyman's, 3300 feet; two miles west of Black Butte, 6800 feet; Willow Lake, 5600 feet. Observed but not collected at the following localities: ten miles north of Red Bluff, 500 feet, January 2, and April 9 and 10, 1928; Blue Tent Creek, 300 feet, April 8 and 15, 1928; Red Bluff, 300 feet, December 19, 1927; Silva's, 270 feet, April 13, 1928; Cone's, 270 feet, April 16 and 24, 1928; Tehama, 250 feet, December 28, 1927; Payne Creek P. O., 1600 feet, April 22, 1928; Manton, 2300 feet, April 18 to 21, 1928, and June 1, 1926; Turner's, 3500 feet, April 26 to 29, 1928; Mineral, 4900 feet (earliest, May 8, 1927); Broke-off Mountain at 8000 feet; Manzanita Lake, 6000 feet; Lake Helen, 8200 feet; Kelly's, 5200 feet, September 2, 1925; Prospect Peak up to about 8000 feet; Snag Lake, 6100 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet (latest, October 14, 1923).

Two adult males collected in June weighed 12.6 and 15.2 grams. An apparently full-grown young bird, July 21, weighed 9.8 grams.

In winter, individuals or small companies of this bird were seen in valley oaks, blue oaks, black oaks, yellow pines, willows, alders, and trees of orchards; also, in Red Bluff, in trees along streets. They fed usually among the branches or twigs of the trees although sometimes foraging also about clumps of mistletoe and on the ground. In the fall one group of twelve was seen in the dead, water-killed trees at the edge of Eagle Lake.

During the summer this warbler was associated with trees of the coniferous forest of the mountains. It was definitely recorded then in the following kinds of trees: lodgepole pine, white fir, red fir, yellow pine, and hemlock.

Audubon warblers were observed "fly-catching" over the water of Lake Helen in mid-July. At Butte Lake in mid-June, 1926, the narrow belt of bare sand around the lake was covered with aquatic insects that were then emerging from the water of the lake. Among other birds, this species was attracted in numbers to this plenteous supply of food. The feeding birds were seen on the sand and in the adjacent fringe of bushes.

On the evening of June 12, 1929, two or three individuals were watched catching flying insects among the tree trunks in the stub-forest bordering the lake near Eagle Lake Resort.

Bob-tailed young Audubon warblers out of the nest were found as early as June 7 (1928) on Battle Creek Meadows. The young of another brood at Spalding's, June 16, were following the parents noisily among some small yellow pines.

On July 26, 1929, two Audubon warblers were seen in flight over the very top of Lassen Peak. By this date, individual birds were evidently moving about far outside their breeding "territories."

On Battle Creek Meadows, June 15, 1925, a female Audubon warbler was seen which showed concern whenever the observer went near a certain thicket of very small pines and willows. The bird came to within three meters of the intruder and distracted his attention by going through an elaborate display. The bird spread its tail fan-wise, showing the white spots to greatest effect, and quivered the partly spread wings, toppling over backwards at the same time, as if unable to hold to the perch. For an instant the observer thought the bird's foot was caught in the forking twigs. The inference finally made was that partly fledged young were in the low vegetation somewhere very near.

Near Eagle Lake Resort on June 12, 1929, a female Audubon warbler was watched in the early morning building a nest. The site was thirty meters up at the tip of the third from the highest branch of a tall yellow pine at the edge of the timber next to the lake. The position was nearly as high as the tip of the tree. Material was gathered from within the forest and out in the stub-forest, usually from the ground, but sometimes from the trees. Once the bird picked material from another nest, apparently a robin's, in an adjacent tree and carried it to its own nest. Flight to and from the nest was usually not direct, the bird alighting first on other limbs lower down or even in other trees.

Dendroica nigrescens (J. K. Townsend)

Black-throated Gray Warbler

Found by us in the section in summer regularly below the 3500-foot contour line on the western slope and at a few places in the far eastern portion. Collected at: Red Bluff, 300 feet; Dale's, 600 feet; Manton, 2300 feet (also observed, April 18, 1928). Observed, but not collected, at the following places: six miles north of Red Bluff, 350 feet, April 15, 1928; Lyman's, 3300 feet; Turner's, 3500 feet, April 28, 1928; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Box Springs, 5300 feet.

Two adult males collected in May weighed 8.1 and 8.9 grams; three females, 6.5, 8.4, and 8.4 grams.

In the western end of the section individuals of this species were observed chiefly in blue oaks, live oaks, and digger pines. North of

Red Bluff, in an almost pure stand of blue oaks on a ridge near Blue Tent Creek, males were heard on May 9 and 10, 1924, in full song and behaving otherwise as if established on their respective nesting territories. On the flat immediately west of Payne Creek P. O., several were singing from black oaks and yellow pines on June 12, 1925. At Turner's one that was watched on April 29, 1928, foraged in turn over twigs of manzanita, incense cedar, black oak, sugar pine, and yellow pine. At intervals it sang.

In the eastern portion of the section, in July, this species was observed most often in junipers, sometimes in sage-bushes on the same dry slopes with the junipers. In moist ravines some individuals were seen in willows.

On June 20, 1929, many males were seen in the junipers and sagebrush on slopes eight miles southwest of Ravendale. On several occasions one male was seen to fly after another and there would be a prolonged chase in and out among the branches of one or two trees.

Near Box Springs, on July 8, 1925, a young black-throated gray warbler was seen just out of its nest.

Dendroica townsendi (J. K. Townsend)

Townsend Warbler

A male obtained at Red Bluff, May 7, 1924, was the only individual of this species encountered in the section. Its weight was 8.8 grams.

Dendroica occidentalis (J. K. Townsend)

Hermit Warbler

Found in the section as a summer visitant at stations from Lyman's to Bogard R. S., and as a transient at lower altitudes on the western slope. Specimens were obtained at the following places: Dale's, 600 feet, May 19, 1924; near Mineral at 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet. Observed also at Lyman's, 3300 feet; Mineral, 4900 feet (earliest seen, May 8, 1927); Turner Mountain at 5500 feet; Manzanita Lake, 6000 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet.

Two adult males collected in May and July weighed 9 and 11.2 grams, respectively. Two adult females taken in May and June, the latter a brooding bird taken with the nest described below, weighed 9 and 10 grams, respectively.

The hermit warbler in the section foraged over the branches of large coniferous trees, especially white fir, sugar pine, and lodgepole pine. A female that was watched on June 26, 1925, at first was fluffing her feathers and acting generally as though just off a nest. A male was singing at frequent intervals from firs and sugar pines overhead. The female proceeded to forage on the sprays of little firs close to the ground; then down into a snow-brush thicket, then actually onto the ground, continually picking at foliage or litter, and now and then uttering a sharp *tsip*. Finally, the bird went off through the young firs and was lost to view.

At two miles northeast of Mineral, 5200 feet, on May 28, 1927, a male hermit warbler was heard singing well up in firs, and presently a female was discovered lower down flitting through the foliage. The latter presently went in a rather direct course through a group of young white firs to a nest, easily seen, resting on a flat mass of foliage. The bird "pivoted" and "spread" her wings. It went off, returning shortly to repeat the maneuvers at the nest, seemingly oblivious to the presence of the observers a few meters off. The male continued to sing, out of sight high up, seventy-five meters or so away, and this despite the fact that the sky was overcast and snow was falling gently at the time. Also snow had accumulated on the ends of the fir boughs, but the nest site was so situated as to be perfectly sheltered from above by crisscrossing sprays from another young fir growing one meter from the stem of the main tree.

When this location was visited again on June 3, the nest contained four fresh eggs. The nest had no attachment whatsoever to the flat frond of foliage upon which it rested; it was lifted without the least "pull" from any connection. The nest rim was 382 centimeters above the ground. The site was 1.3 meters out from the main trunk on a practically horizontal branch. The tree was not over eight meters in height. Close about were big sugar pines, firs, cedars, and yellow pines, so arranged that the site was shaded most of the day. On the second visit to the location the male did not put in an appearance, although one was singing not far off.

The outer part, and base, of the nest was made up chiefly of old weathered pine needles, whose ends projected stragglingly. Within this were strips of shredded bark. The inner lining was of still finer flax-like plant fibers, with a few feathers of some larger birds including flicker. The concavity of the nest (as preserved in the Museum) is in diameter 47 millimeters, in depth 35. One of the eggs is abnormally shaped in that it is elliptical (almost equal-ended). The measurements of the set are in millimeters as follows, the last being of the abnormal egg: 17.2 × 12.9; 17.3 × 13.0; 17.0 × 12.9; 16.3 × 11.8.

Oporornis tolmiei (J. K. Townsend)

Tolmie Warbler

Found by us in summer in the central mountainous portion of the section from 3300 to 7000 feet altitude. Collected at: ridge two miles northeast of Mineral, 5500 feet; two miles west of Black Butte, 6800 feet. In addition observed at: Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; Prospect Peak at 7000 feet.

Two adult males collected in June weighed 9.8 and 10.7 grams. Two adult females, July, weighed 9.2 and 9.4 grams.

This warbler was found in brushy thickets in almost the same places that fox sparrows frequented. However, the present species showed a preference for slightly more moist or shaded situations than where the bulk of the sparrows lived.

A nest containing four eggs slightly incubated was collected, June 18, 1925, near Mineral. The structure was in a scraggly, open growth of snow-brush on dry ground, a small yellow pine within three meters; but the site was sunny during the hottest part of the day. The nest rested among fine dead twigs of the snow-brush, with a slanting live stem of the same eight centimeters overhead. No single twig directly supported the nest, but its compact structure enabled it to rest securely amid the fine twiggery. The nest rim was 19 centimeters above the ground surface. The female was rather shy and would sneak off along the ground, keeping quiet and out of sight. No male was noted in the immediate vicinity.

On June 28, 1924, at two miles west of Black Butte a nest was found which held four well-feathered young. This nest was slightly over one-half meter above the ground in a bush on a steep moist bank. In this case the female showed excitement and fluttered about near the feet of the observer.

A late date for a nest with eggs is July 8, 1925, when one containing four eggs was discovered in Battle Creek Meadows. The brooding bird was flushed from this nest on July 11, but when the site was again visited four days later no bird was about and the nest itself was empty, tipped to one side. Half an eggshell was in plain view and one whole egg was hidden beneath débris.

Young of this warbler out of their nests were seen near Mineral on June 23, and July 19 and 29, 1925.

Sheldon (1907, p. 190) records that he saw this warbler "with young" at Eagle Lake (southwest end) in the summer of 1905.

Geothlypis trichas occidentalis Brewster

Western Yellow-throat

Summer resident in the western part of the section below 1000 feet altitude (where also remaining sparsely through the winter), and in the eastern part eastward from Eagle Lake. Specimens obtained at the following places: Red Bluff, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet, October 13, 1923; Petes Valley, 4500 feet. Observed at the following additional localities: Silva's, 270 feet, April 13, 1928; Cone's, 270 feet; Bloody Island, 350 feet; Elliott's, 1000 feet, December 25, 1927, and April 14, 1928.

Weights of three adult males from the western part of the section in May, were 9.1, 10.4, and 10.8 grams. Two males from the eastern part of the section, May (adult) and October (bird-of-the-year), weighed 10 and 10.3 grams respectively. Two adult females from Dale's in May weighed 10.8 and 11.9 grams. A full-fledged juvenal from the eastern end of the section, July 15, 1928, weighed 10 grams.

Yellow-throats frequented the vegetation bordering such streams, ditches, springs (fig. 13), and ponds as occurred toward the ends of the section. Willow, valley oak, cat-tail, grapevine, and numerous weeds and shrubs accompanying these larger plants, furnished cover and foraging and perching places suitable for this species.

Females collected on May 20 and 23, 1924, near Dale's contained each a full-sized yolk in the oviduct. Later, males were singing in the respective territories of these two females, from perches five and eight meters above the ground.

The severe winter cold in the eastern portion of the Lassen section probably reduces the supply of food available for this bird to such a small amount that all of the species must seek a more favorable region at that season. In the lower western part of the section, of warmer winters, the food supply is reduced also; but there the reduction is more likely due to the prolonged dry season and its effects upon the vegetation and, in turn, upon the invertebrate life. At a pond at Elliott's there is a permanent and uniform water supply which results in an abundance of vegetational cover and therefore the presence of invertebrate food at all seasons. This was the only place in the section where yellow-throats were found by us in midwinter. At other places no birds were seen until April 13, and in 1928 the species did not become common until two weeks later than that.

After much examination of the series of twelve specimens obtained within our section in comparison with appropriate material from elsewhere, the conclusion is reached that all the former must be included under the subspecific name *occidentalis* which was based on Great Basin birds; that is, east and west end specimens are not distinguishable, and west-end birds give no adequate characters for using for them the name *scirpicola*, which name has sometimes been applied to yellow-throats from the Sacramento Valley.

Icteria virens longicauda Lawrence

Long-tailed Yellow-breasted Chat

A summer visitant to the western part of the section up to 3300 feet altitude and to the southeastern portion of the section. Collected at: Blue Tent Creek, 300 feet; Red Bluff, 300 feet; Dale's, 600 feet. Observed but not collected at the following places: Silva's, 270 feet, April 13, 1928; Bloody Island, 350 feet; Mill Creek, 260 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Secret Valley, 4500 feet.

Sheldon (1907, p. 190) intimates that, in the summer of 1905, he found the chat "breeding" at Eagle Lake. Details are not given.

Two adult males, May 8 and 10, weighed 25.1 and 28.8 grams, respectively. A brooding female, May 19, 1924, weighed 30 grams.

Chats were limited closely to the tangles of tall weeds, brush (willow, rose, blackberry, elder) and grapevines that bordered the lower stream-courses. There the birds spent most of their time concealed under the cover of the densely growing vegetation. However, this tendency to keep out of sight was compensated for by the characteristic of the birds to be noisy. Sometimes a bird was seen perched above the screen of the thicket, but at such a time it was quiet in both manner and voice.

The chat was the noisiest bird in summer in the western part of the section. It was heard from daylight till dark and at intervals during the night. The utterances were given for the most part slowly, in short series of "words," with an interval between each two series. Many of the notes of this species resembled those of other birds so closely as to be practically indistinguishable to the hearer. Chats thus "imitated" only notes, not long or rapid songs.

Facsimiles that were heard and checked within a few days in late May and early June were as follows: gray squirrel (the "coughing" note); young turkey (of which many were herded around the ranch at Dale's to feed on grasshoppers); willow woodpecker (the high-pitched "whinnying"); Bullock oriole (the harsh call-note only); crow (the caw, repeated four to six times, or, sometimes, just once, accurately given); ash-throated flycatcher (call-note); wren-tit (without the terminal trill, but accurate in pitch and timbre—no wren-tits were seen within six miles of this place [Dale's]); Pacific nighthawk (*pe-ärk,* perfectly rendered); California jay (one of the staccato calls); Steller jay (a staccato note); flicker (the *kuk-kuk-kuk* note); yellow-billed magpie (perfect, though magpies were not found by us in the near neighborhood); meadow-lark (a call-note); slender-billed nuthatch (*yank,* loud nasal note); robin (*cluck-cluck,* note of mild alarm).

Other notes of the chat that were heard could not be ascribed definitely to some other species. It was thought that these represented either imperfect imitations or else notes inherently of the chats themselves. Before an individual would indulge in a song flight it would "staircase" up to the top of a tree, giving voice all the while, then launch forth in a circuitous course, flopping the wings and tail rather slowly, the tail meanwhile drooping curiously.

The bodily movements of this bird were far from true-warbler-like; they were deliberate, and an individual could keep quiet for many seconds at a time.

Birds were heard singing, though fitfully, as late as July 25 (1925, at Dale's).

On May 19, 1924, near Dale's a nest was found eighty centimeters above the ground among the stems of a leafy rose thicket overgrown with a grapevine. The four eggs in this nest were slightly incubated.

A nest was found, May 28, 1926, on the flood plain of a stream near Bloody Island. It was slightly over two meters above the ground in a vine that covered a dead tree. A large cottonwood close by furnished shade. The site was about on a level with the top of the undergrowth of willows, weeds, and elders. Tendrils and shreds of bark of grapevines had been used in building the nest. There was no solid support, the structure being held in place by small stems of the grapevine. Four downy young were in this nest. One parent came and scolded excitedly when the nest was disturbed, but did not come nearer than six meters from the intruder.

A young bird, out of its nest, still unable to fly well, was found, May 28, 1924, in a dense grapevine thicket near Dale's. Here the parent birds came close to the observer and showed concern.

Wilsonia pusilla pileolata (Pallas)

Alaska Pileolated Warbler

A transient through the section; found by us only in the lower western portion. Collected at Red Bluff, 300 feet, May 3 and 4, 1924, and at Dale's, 600 feet, May 21, 1924. Observed also at Cone's, 270 feet.

Weights of four males collected in May were 7.3, 8.1, 8.3, and 9.3 grams.

This warbler was observed in its late-spring migration in willows, valley oaks, blue oaks, and in clumps of buck-brush, sometimes far from water. A bird seen in a clump of poison oak close to a creek at Cone's, April 24, 1928, was thought to be of this subspecies.

Wilsonia pusilla chryseola Ridgway

Golden Pileolated Warbler

A summer visitant to the section at stations from Battle Creek Meadows to Eagle Lake. A single specimen was obtained three miles northeast of Mineral, at 6500 feet altitude. Observed but not collected at the following additional localities: Battle Creek Meadows, 4800 feet; Mineral, 4900 feet (earliest seen, May 11, 1927); Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; near Lake Helen at 8000 feet; Kelly's, 5200 feet, September 2, 1925; Eagle Lake Resort, 5200 feet.

An adult male, June 26, weighed 7.1 grams.

This race of pileolated warbler in summer was limited closely to alder and willow thickets bordering ponds, along streams and in and around the edges of moist meadows. These two plants, alder and willow, appeared to furnish the chief factors favoring the initial choice of this habitat, rather than any of the plants associated with them. On May 17, 1924, males in full song were established in the yet leafless willows lining the steep watercourses between Soupan Springs and Lake Helen.

The song of a pileolated warbler listened to near Black Butte, June 30, 1924, was recorded (Hunt, MS) as follows: a smart, rapid, staccato *sip-sip-sip-sip-sip-sip-sip-sip-sip*—usually accelerated after the first four "*sips.*"

Sturnella neglecta Audubon

Western Meadow-lark

Recorded during spring, summer and autumn in western part of section at many localities below 5000 feet altitude, and in eastern part from near Bogard R. S. eastward (fig. 113); in mid-winter only from Sacramento Valley up to 600 feet altitude. Specimens collected at: Dale's, 600 feet; Lyman's, 3300 feet; five miles north of Fredonyer Peak, 5700 feet; Petes Valley, 4500 feet. Observed at

following additional localities: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Coyote Creek, 270 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Bogard R. S., 5500 feet; Spalding's, 5200 feet; Pappoose Valley, 5200 feet; Gallatin's, 5200 feet; eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet.

A male taken at Dale's in December weighed 96.4 grams. One obtained at Lyman's, June 13, weighed 105 grams. An adult female from Dale's, shot May 31, weighed 80 grams. A female from five miles north of Fredonyer Peak, October 4, 1924, weighed 56 grams. A full-fledged young female from Petes Valley, July 14, weighed 74.8 grams.

Individual meadow-larks were definitely recorded from the following kinds of places on more or less open ground: rocky mesa with few scattering blue oaks, amid lava blocks on rocky ground, on fence at roadside, in tops of lone blue oaks in pastures, in willow at edge of hay field, perched on clumps of wild rye and sage-brush, on a grain shock in a stubble field, on ground in hay fields, and perched on shocks of hay, in grass among sage-bushes, in taller grass of old cultivated fields and in second-bottom along creek, on open meadow, on small meadow near lake, around and in alfalfa patches, in damp grass patch near corral, in drier parts of a meadow, and in open fields and pastures.

At Cone's, December 29, 1927, meadow-larks were numerous on the more open ground in the creek bottom. One flock of more than 200 was flushed in mid-afternoon from ground partly covered with weeds. When Coyote Creek was visited on January 2, 1928, meadow-larks were exceedingly numerous, in full song, and incessantly flying about, in pairs, in flocks and singly—an obvious reaction to the bright afternoon sunshine.

Xanthocephalus xanthocephalus (Bonaparte)

Yellow-headed Blackbird

An immature male, weight 80 grams, was collected at Red Rock P. O., on July 24, 1928.

On May 24, 1927, several brilliant adult males were seen about the edge of Wilson Lake, in "bachelor" two's or three's, and some out in patches of dead grass in the lake whence their curious notes frequently sounded. A few were noted at Eagle Lake on May 18 and 25, 1925. In addition to several individuals that were seen at roadsides and in irrigated fields in the vicinity of Red Rock P. O. in July, 1928, more than 100 were seen in the flooded hay meadow in Red Rock

Creek valley four miles northwest of that place. On the marshy ground the birds were down in the sedges or flying in flocks of other species of blackbirds. It was thought that they had bred there.

Several yellow-headed blackbirds were seen, June 8, 1929, in flight over marshy parts of Petes Valley. On June 20 and 24, many individuals were scattered over marshy portions of Feather Lake. Several females were seen carrying wet nesting material from one place to another in the patches of bulrushes. Males were most often seen in flight or perched and preening close to water in the edge of clumps of bulrush.

Townsend (1887, p. 213) reports seeing very few yellow-headed blackbirds at Red Bluff, but that "large numbers were found breeding in the 'tules' bordering Eagle Lake" the last of June, 1884.

In 1905, Sheldon (1907, p. 189) found this blackbird nesting on the northwest side of Eagle Lake where there was then "a great growth of tules."

Agelaius phoeniceus nevadensis Grinnell

Nevada Red-winged Blackbird

Found in summer, present and usually nesting, in widely scattered localities through the section from the extreme eastern end westward to the edge of the Sacramento Valley—at least to Elliott's (fig. 103). Localities represented by specimens are as follows: Elliott's, 1000 feet; Manton, 2300 feet; Manzanita Lake, 6000 feet; Battle Creek Meadows, 4800 feet; Willow Lake, 5600 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; five miles north of Fredonyer Peak, 5700 feet, September 30 to October 8, 1924; Petes Valley, 4500 feet; Dransfield's, 5300 feet, October 16, 1924; Red Rock P. O., 5300 feet. The species was observed, but no specimens collected, at: Turner's, 3500 feet, April 25, 1928; Butte Lake, 6100 feet, June; Feather Lake, 5500 feet, June; western side of Madeline Plains, 5300 feet, June.

Two males from Eagle Lake, adults in May, weighed 67 and 78 grams. Weights of seven June-taken adult males were 60, 61, 61.7, 63.3, 64.4, 65.6, and 67.3 grams. Weights of four adult males in October were 65, 66.4, 68.4, and 68.8 grams. Two adult females from Elliott's and one from Manton, June, weighed 36.1, 45.1, and 42 grams, respectively. A July-taken adult female from Willow Lake weighed 43 grams. Two adult females taken in the eastern part of the section in October weighed 40 grams each.

In the spring of 1925, red-winged blackbirds seen on the west side of Eagle Lake were thought to be just arriving on May 18. On Battle Creek Meadows the first arrivals were noted in 1927 on May 14. The latest fall record for this bird in the eastern part of the section is for October 16, 1924, when specimens were collected at Dransfield's.

Red-winged blackbirds when found were always in the near vicinity of water. Vegetation such as cat-tail, *Scirpus,* willow, alder, and coarse grass in or close to a lake, pond, wet meadow, stream, or irrigation ditch was used for perching and nesting. A large part of the foraging was done on the surface of the ground, in or near places of this character.

In June, 1928, when, because of rapid lowering of the water level of Eagle Lake, tule beds and other marsh vegetation had entirely disappeared from the western and northern shores of that lake, no red-winged blackbirds whatever were seen there.

Several nesting pairs of this species were seen, April 14, 1928, around the pond at Elliott's. None of the birds showed much concern over an intrusion by the observer. One nest that was seen was hanging 1¼ meters above the water in a clump of tall *Scirpus.* In it was an egg, the first of a set. No bird was seen in the immediate vicinity of this site.

The red-winged blackbirds in the neighborhood of Red Rock P. O., in the summer of 1928, had gathered into good-sized flocks by July 24. These flocks were seen mostly close to irrigation ditches or in the wet hay meadows where the birds foraged over the moist ground.

The nesting birds from Elliott's and Manton are here listed under the name *nevadensis* even though they show definite tendencies—in shape of bill, color pattern of shoulder patch in male, and general body color of female—toward the Sacramento Valley form, *californicus.* In other words, there is clear evidence of intergradation across the territory exemplified by our "section," between the Great Basin subspecies and that of the Great Valley of California.

Several nesting pairs of this blackbird were observed, June 8, 1929, in the marshy portions of Petes Valley. One nest containing three downy young was 15 centimeters above the water. It was fastened in a clump of sedges and was firmly built of grass and sedge stems. The cheeping of the young birds attracted attention to this nest. When approached closely the three young stretched their necks upward and opened their mouths widely for food. Another nest was in a position similar to the last. This one was two meters from a narrow open stretch of water. The site was surrounded by sedges and grasses one-half meter in height. Contents were two eggs and two downy young. These young alternately opened their mouths when a sound was made close by.

One nest was three-fourths of a meter above the ground in the center of a clump of rabbit-brush growing on dry ground. Other similar bushes stood near. The brooding female flew off when approached within fifteen meters, revealing four eggs in the nest.

A nest in a clump of grass in the wet part of the valley had its base just above the water. A single downy young in this nest called and chirped with open mouth as it was approached.

One nest was seen that had been torn from its base just above the water in a marshy place and its contents (eggs) crushed and eaten, it was thought, by a coyote.

Agelaius phoeniceus californicus Nelson

California Red-winged Blackbird

Present in summer, though sparingly, at a few localities on the floor of the Sacramento Valley, in the extreme western end of the section (fig. 103). Specimens were preserved from Coyote Creek, 270 feet, and from a ranch four miles south of Red Bluff. Curiously, no *Agelaius,* of any species or subspecies, was found within our section in the winter season.

Two adult males from Coyote Creek, May 6, 1924, weighed 57.7 and 65.5 grams.

At a roadside pool two miles north of Red Bluff on April 23, 1928, at least two pairs of red-winged blackbirds were established for nesting in small clumps of cat-tail. Two newly constructed nests were seen; at least one of these was empty. Each was in a clump of cat-tail, close to one-half meter above the water. Several birds were perched on telephone wires close by. They called with concern when the nesting sites were approached.

Agelaius tricolor (Audubon)

Tri-colored Red-winged Blackbird

A male was shot near Red Bluff from a flock that was flying south on the evening of May 12, 1924. It weighed 62 grams. Another male was shot, April 12, 1928, and several flocks purely of this species were seen in fields or on posts at roadsides, seven miles southeast of Red Bluff in the valley of the Sacramento River. This bird weighed 69.4 grams.

Icterus bullockii (Swainson)

Bullock Oriole

A summer visitant in the section west of, and below the altitude of, Manton, and from Eagle Lake eastward (fig. 114). A specimen obtained at Red Bluff, 300 feet. Observed at following additional localities: four miles south of Red Bluff, 270 feet, April 13, 1928; Cone's, 270 feet, April 16, 1928; Bloody Island, 350 feet; Mill Creek, 260 feet; Tuscan Springs, 1200 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet, April 18, 1928; Spalding's, 5200 feet, May 25, 1925; north end of Eagle Lake, 5200 feet; south end of Grasshopper Valley, 5300 feet; Petes Valley, 4500 feet; eight miles south of Ravendale, 5400 feet; Secret Valley, 4500 feet; four miles northeast of Red Rock P. O., 5400 feet; Box Springs, 5300 feet.

In 1884, Townsend (1887, p. 214) saw the first Bullock orioles at Red Bluff on April 5. There they subsequently nested numerously ''in the cottonwoods and locusts about the ranch buildings.''

A female taken by us in early May at Red Bluff weighed 29.2 grams.

Bullock orioles were observed usually about good-sized trees, either those in the fringes bordering streams or isolated out in fields. Kinds of trees frequented included valley oak, sycamore, cottonwood, digger pine, cherry, aspen, willow, black oak, yellow pine, and juniper.

At Cone's, April 24, 1928, an oriole was seen carrying nesting material to one of the large valley oaks out in the center of the field. Seemingly the birds begin their nesting almost as soon as they arrive on the breeding ground.

On June 10, 1929, one was carrying nesting material in Petes Valley. Six individuals were seen about the group of cottonwoods in the center of the valley. Only one of the males was in the full, brilliant plumage.

A nest was found, June 18, 1929, near a small stream on a juniper covered slope eight miles south of Ravendale. The nest was in the end of a bough of juniper and four meters above the ground. Both birds of the pair were near. The nature of the contents was not determined.

At the north end of Eagle Lake, on June 18, 1928, a nest was seen five meters above the ground in a juniper surrounded by a sea of sage-brush. The nest hung beneath the end of a heavily foliaged branch, and its grayish bark-fiber construction rendered it conspicuous in contrast with the deep yellow-green of the juniper. The behavior of the birds here led to the belief that incubation was under way, as also in the case of other pairs of orioles in the same vicinity at the same time.

Young orioles were nearly ready to leave the nest at Box Springs on July 8, 1925. At that place the birds were closely restricted to the vicinity of an aspen grove.

Similarly, in Petes Valley at least one pair was present about a small grove of cottonwoods in the center of the valley. On July 13, 1928, an adult was seen carrying food to a nest ten meters above the ground in a cottonwood. On the same day a young bird not yet able to fly was calling in some weeds, close to the ground.

A nest that had been used earlier in the season was found, July 25, 1928, in a willow at the side of a cañon in the extreme northeast corner of the section, beyond Red Rock P. O.

A non-breeding female was shot near Red Bluff on May 6, 1924. Color notes taken on the fresh bird were as follows: tarsi and toes, deep glaucous-gray; lower mandible, clear green-blue gray, paling along cutting edges; upper mandible, olivaceous black; iris, sepia (comparisons made on the spot with Ridgway, 1912).

Euphagus cyanocephalus minusculus Grinnell

California Brewer Blackbird

Found in spring, summer and fall from one end of the section to the other, but not numerously above 6000 feet altitude. In winter found only west of and below about the 1000-foot contour. Specimens represent the following localities: Cone's, 270 feet, December; Dale's, 600 feet, May and December; Manton, 2300 feet, June; Battle Creek Meadows, 4800 feet, June; five miles north of Fredonyer Peak, 5700 feet, October 5, 1924. Observed also at following additional stations: Blue Tent Creek, 300 feet, January; Red Bluff, 300 feet; four miles south of Red Bluff, 280 feet; Bloody Island, 350 feet; Mineral, 4900 feet, May 27, 1927; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet, July 2, 1924; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet, May and June; Pappoose Valley, 5200 feet; Spalding's, 5200 feet, May and June; north end of Eagle Lake, 5200 feet, June; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet, June and July; Box Springs, 5300 feet, July 8, 1925.

Two males shot at Cone's in late December weighed 74.6 and 77.9 grams. Four females of same data weighed 57.6, 58.1, 60.3, and 61 grams. A December collected female from Dale's weighed 60.7 grams. A female from Manton weighed 59 grams in early June. One from Battle Creek Meadows, June 24, weighed 58.8 grams.

Here is a species that foraged almost exclusively on the ground and used the tree tops as perching and roosting places. Favorite foraging grounds appeared to be freshly plowed fields, orchards, meadows and pastures, and moist ground bordering streams, irrigation ditches, and lakes. Nesting sites were usually chosen within short distance of some suitable forage place of one of the types just mentioned.

Almost everywhere that killdeer were seen Brewer blackbirds foraged, though the reverse statement cannot be made. This frequent occupancy of common ground by two such distantly related bird species clearly indicates similar adjustments for seeking food and similar dependences in such places for safety while gathering the food.

On the morning of May 14, 1924, a female Brewer blackbird was seen to fly to the edge of the Sacramento River with its bill full of insects, and to souse the bill and contents into the water. The bird then flew off.

As soon as the young birds were grown in the summer, the blackbirds congregated into flocks which wandered over the country until the beginning of the next following breeding season. These flocks congregated in the evening to form larger companies which roosted together in certain groves of tall trees.

On April 12, 1928, a Brewer blackbird was seen near the Sacramento River carrying nesting material. Although some pairs were seen, most of the blackbirds were in small flocks at that time.

Close to Cone's, on April 16, 1928, a female blackbird was building a nest on the top side of, and at the end of, a lower limb of a valley oak. The tree was one of a row bordering the highway. The site was eight meters above the ground and was over the edge of the pavement. The bird gathered the material from the ground and from a rack in an adjacent feed-lot and carried it in large bunches to the nest. Leaves on the limb partly concealed the nest. The male attended the female but it was not seen to carry any material. At the same time, in a shallow rain-pool in the feed-lot, a group of fifteen blackbirds was bathing and splashing in the water even though rain was falling steadily.

A blackbird at Mineral was carrying what appeared to be nesting material on May 27, 1927.

At Manzanita Lake Brewer blackbirds nested on stumps and in drowned brush-clumps out in the water. On June 7, 1926, two nests on stumps contained young birds and another in some brush six meters out from the shore had young nearly grown. The parent birds were bringing food from the ground on a chaparral-covered slope one-half to one mile away from the lake. They made regular trips and were seen nearly every time to carry insect food back to the lake. It was rather unexpected to see these birds going so far to get food from dry ground, when insects were abundant around the edge of the lake.

On June 17, 1927, at this lake the birds were foraging over the snags and floating logs at the water's edge and were feeding young already out of their nests. Ten or more individuals were seen on that day.

Families of young were seen at large in the neighborhood of Dale's as early as May 23, 1924.

At the north end of Eagle Lake, June 18, 1928, a nest was found 67 centimeters up in a small juniper spire. It contained one "dented" egg. Another nest, with three small young, was in a dense, gray-leaved, fruiting gooseberry bush and only sixty centimeters above the ground. This nest was fully a quarter of a mile from the lake shore. The birds here were foraging at the water's edge, while their nests were situated in the driest sorts of places back up the sage-brush-covered hillsides.

Young Brewer blackbirds were noisily following adults in the neighborhood of Eagle Lake Resort on June 16, 1928. At the side of Battle Creek Meadows on June 23, 1925, a female was bathing and preening, as if just off a nest. On July 8, 1925, young blackbirds at Box Springs were nearly ready to leave their nests.

On June 8, 1929, this species was found numerously in Petes Valley. A nest was seen on the ground in a clump of sedge in a marshy portion of the valley. The five nearly fully feathered young in the nest made no move or sound when approached and even touched. Adults, apparently parents of this brood, were perched in a bush thirty meters away. The nest site was surrounded by shallow water. Another nest in a position similar to that just described contained two eggs, evidently an incomplete set.

A female was seen, June 11, 1929, at the edge of Pappoose Valley, carrying nesting material. Its bill was full of dead pine needles evidently picked up from the ground. The bird was in a tall yellow pine along with a male.

At the south edge of Eagle Lake on June 11, a nest was seen in the stub-forest one meter above the ground in the broken top of a stub. The female was seen to feed the three downy young and then fly toward the edge of the lake. The course was changed and the bird lit in a belt of grasses and sedges. There it picked up food objects, but later flew on to the edge of the lake and foraged there. (See also fig. 144.)

On the next day a nest was seen on the ground at the base of and beneath a small stub, leaning at a forty-five degree angle. The inside diameter at the rim was 100 mm., outside diameter, 150 mm. The rim projected slightly above the ground level. This nest had been flattened out of shape by crowding of the four large young, whose feathers were just beginning to break their sheaths. The site was near the middle of a grassy belt in the stub-forest and 150 meters back from the edge of the lake.

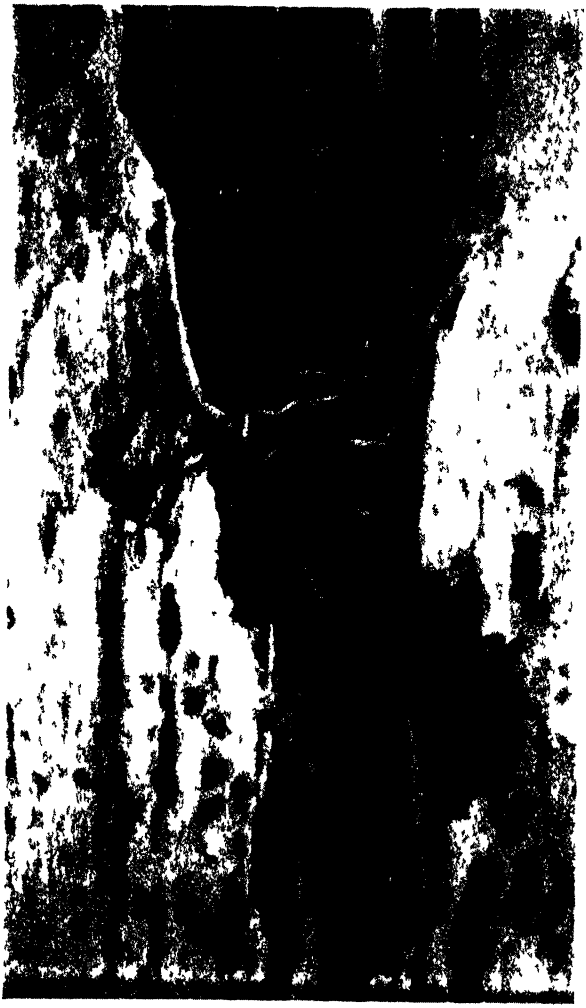


Fig. 144. Nest and four eggs of California Brewer blackbird (*Euphagus cyanocephalus minusculus*) in broken top of stump at margin of Eagle Lake. Photograph taken May 16, 1925. Mus. Vert. Zool. no. 4581.

Another nest at that place was one and two-thirds meters up, on the broken top of a small stub in the middle of the stub-forest belt. It contained five eggs on June 12. The lining of this nest was composed of rootlets.

In the evening of June 12, 1929, many Brewer blackbirds were catching flying insects among the stubs at the south side of Eagle Lake. The insects were sufficiently large for actual catches to be seen.

Breeding specimens of the Brewer blackbird from the Lassen section, as compared with *minusculus* from west-central California, show slightly longer, but relatively slenderer, bills; but as compared with the subspecies *cyanocephalus* from Nevada and from the Colorado River eastward they show slenderer, slightly less bulky, bills and lesser wing lengths. While obviously intermediate between the two named races, their geographic location, nearest to the metropolis of *minusculus,* has led us to place them, perhaps rather arbitrarily, under the latter name.

Piranga ludoviciana (Wilson)

Western Tanager

Generally distributed in the section in summer from near Payne Creek P. O., 1600 feet, eastward to Gallatin's, on Eagle Lake. Collected at: ridge near Mineral, 5200 feet (earliest observed, May 9, 1927); Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; Willow Lake, 5600 feet. Observed also at the following additional localities: Red Bluff, 300 feet, May 4 to 9, 1924; Dale's, 600 feet, May 19 to 26, 1924; Payne Creek P. O., 1600 feet, June 12, 1925; Manton, 2300 feet, June 3, 1926; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Turner Mountain, 6300 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Kelly's, 5200 feet, September 2, 1925; Prospect Peak, 8340 feet; Snag Lake, 6100 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet, May 21, 1925; Spalding's, 5200 feet; Gallatin's, 5200 feet.

Two adult males, June 17 and July 5, weighed 26.8 and 28.6 grams, respectively. An adult female, June 6, weighed 30.4 grams. A juvenile with rectrices and outer primaries still ensheathed at bases, sex undetermined, July 21, weighed 31 grams, more than did any of the adults.

During the migrations through the western part of the section tanagers were most often observed perched in blue oaks, valley oaks, or digger pines. During the summer the birds were found in the pines, incense cedars, and firs in the mountainous portion of the section.

On May 22, 1927, near Mineral, a pair of tanagers was watched as they foraged close together in an incense cedar within ten meters of the observer. The male kept making low soft-sounding notes, the *churtig* note "whispered," with an occasional mellow whistle.

A female was watched for fifteen minutes, June 24, 1929, near the outlet of Butte Lake. It was carrying one piece of fine nesting material and evidently was prospecting for more. Searching was done over the ground, on rocks, and on the lower limbs of trees.

Zamelodia melanocephala capitalis (Baird)

Pacific Black-headed Grosbeak

A summer visitant to the western part of the section, occurring eastward to Summit Creek. Found also at a few localities in the eastern end of the section. Specimens were obtained at: Red Bluff, 300 feet; Lyman's, 3300 feet; and Summit Creek, 5200 feet. Observed also at the following additional stations: Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; north end of Eagle Lake, 5200 feet; eight miles southwest of Ravendale, 5600 feet.

A male from Red Bluff, May 12, weighed 36.7 grams; one from Lyman's, June 13, 42 grams; one from Summit Creek, June 17, 44 grams. None of these is an old adult, that is, probably, more than one year of age.

The black-headed grosbeak was most often observed close to streams, in or among willows, alders, or cottonwoods. Singing males picked the open, dead tops of trees for perches. Some were seen along fence rows and in groves of valley oaks. At the north end of Eagle Lake, June 18, 1928, males were in full song among the scattering junipers and mountain mahoganies within 150 meters of the open lake shore.

Near Red Bluff this bird was noted earliest, in 1928, on April 25, and in 1929, on April 18. The earliest spring record at Mineral was May 8, 1927, when one was heard in full song early in the morning.

On May 30, 1926, these grosbeaks were feeding on cherries in an orchard close to Manton.

Near Mineral, June 15, 1927, a female was flushed from three well incubated eggs in a nest one and one-half meters up in a young incense cedar in a group of these trees on a gentle southwest-facing slope. The nest was against the stem and supported by twigs given off at that height.

Another nest was seen on June 18, three meters up among twigs of a slender willow stem in a big clump of willows over a stream in Battle Creek Meadows. The female was sitting on the three eggs it contained.

Guiraca caerulea salicarius Grinnell

California Blue Grosbeak

Present in summer below 600 feet altitude in the western end of the section. Collected at Dale's, 600 feet. Observed also at Red Bluff, 300 feet; along the Sacramento River between Red Bluff and Tehama; at Coyote Creek, 270 feet; at Bloody Island, 350 feet; and at Mill Creek, 260 feet.

A year-old male, taken May 20, 1924, at Dale's, weighed 27.2 grams.

One male was heard singing lustily from a mass of green willows on an island in the Sacramento River. Another sang from the highest twig of a valley oak overlooking a willowy slough. Males sometimes sang from telephone wires along roads, especially where these were near small streams. One was seen to fly to a bush in a fence row.

The more dense, low-growing vegetation bordering the streams in the lowest and hottest part of the section apparently led to the choice of that habitat by the blue grosbeak.

Passerina amoena (Say)

Lazuli Bunting

Found regularly in summer in the western end of the section, from the vicinity of Mineral westward; also noted from the vicinity of Eagle Lake eastward. Specimens were preserved from Dale's, 600 feet, and from near Eagle Lake Resort, 5200 feet (June 4, 1925). Presence established by observation only, at the following additional places: Red Bluff, 300 feet (first seen, May 10, 1924); Cone's, 270 feet (April 24, 1928, earliest date for the section); Bloody Island, 350 feet; Mill Creek, 260 feet; Manton, 2300 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet (June 13, 1925, earliest date for high altitude); eight miles southwest of Ravendale, 5600 feet; Secret Valley, 4500 feet.

A male and female from Dale's weighed 14 and 15 grams, respectively; a male from Eagle Lake weighed 16 grams.

Townsend (1887, p. 221) records the first appearance of this species at Red Bluff in 1884, as on May 1.

Among the types of places in which the lazuli bunting was observed in the section, the following were recorded definitely: in the top of a valley oak; in buck-brush; in a cottonwood grove; in an open field at the edge of a grove of pines; in willow bog; in weeds along fence row; area of willow thickets, tall grass, blossoming herbs, and luxurious veratrum, with here and there fallen lodgepole pine snags, and some standing trees of same species; in a dead lodgepole pine above low thickets of same; in thicket bordering stream.

Near Mill Creek on June 8, 1912, a nest was found one-half meter above the ground close to the stream, fastened to stems of three weeds.

The nest was composed of dry straws and was lined with horsehairs. Although there was but one egg, the nervous behavior of the female was sufficient to lead to discovery of the nest. On June 13 there were two eggs in this nest.

On June 25, 1924, a nest was found in a cottonwood grove at Battle Creek Meadows. The structure was slightly over one-half meter above the ground, supported in a fork of a shoot from the base of a cottonwood tree; it contained three young, perhaps a week old.

Another nest, also one-half meter up, was found July 11, 1925, in a thick, young willow clump at the edge of Battle Creek Meadows. Both adults showed much concern over a close approach to the nest. One of the four nearly grown young left the nest hurriedly when it was approached. On July 15 the nest was empty and all four young, with both parents, were in a near-by thicket.

Passer domesticus domesticus (Linnaeus)

English House Sparrow

A single specimen was collected at Petes Valley, 4500 feet, July 12, 1928. Individuals were observed at the following other stations: Red Bluff, 300 feet; Bloody Island, 350 feet; Ravendale, 5300 feet; Secret Valley, 4500 feet; Red Rock P. O., 5300 feet; Box Springs, 5300 feet.

The one collected, an adult male, weighed 25.8 grams.

This alien species was nowhere in the section conspicuous. A few individuals were seen in dooryards and in a park at Red Bluff. At every other place in the section where this sparrow was observed it was in the neighborhood of farm buildings; and in every place but one the buildings were occupied by people. At Petes Valley, the present house at the ranch where the sparrows were found was occupied by persons only at infrequent intervals. There the sparrows had their nests in the tops of tall cottonwoods that had been planted around the ranch house that was formerly there. Young in these nests were being fed by the parents on July 11, 1928.

On April 19, 1929, at Red Bluff a male English sparrow perched on the rod in front of the radiator of our truck, parked on the main street, and picked at insects that were wedged into the crevices within the radiator's structure.

A pair of English sparrows was observed, June 18, 1929, about a ranch house near Box Springs. Apparently this was a case of the spread of the species into a new locality, for persons living at the ranch had never seen the birds there previous to that year.

Hesperiphona vespertina brooksi Grinnell

Pacific Evening Grosbeak

Generally distributed in summer in the central portion of the section between Lyman's and Eagle Lake. Found by us in the autumn only to the eastward in the section. Specimens preserved from: Mineral, 4900 feet; two miles west of Black Butte, 6800 feet; Kelly's, 5200 feet; Termo, 5300 feet. Observed also at the following stations: Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; Prospect Peak at 7000 feet; nine miles southeast of Bogard R. S., 5500 feet; Spalding's, 5200 feet.

An adult male collected in June weighed 49 grams; a full-fledged young male, July 8, weighed 55.6 grams. An adult female in June weighed 48.4 grams. Weights of two males, ''excessively fat,'' collected in October were 64 and 76.4 grams; two females, 63 and 70.

This species was found nearly always in close association with the coniferous trees of heavy forest, either perched high in the trees or in flight between them. As exceptions to this statement, on Broke-off Mountain, July 27, 1925, a group of five alighted on the dead lower branches of a fir in the red fir belt between 7000 and 8000 feet. A male was seen, July 3, about a cow-corral on Battle Creek Meadows, alighting on the ground and on fence rails; it behaved much as would a linnet.

Near Kelly's, in early September, 1925, a group of restless grosbeaks was observed feeding mostly high in big fir trees, although a little later some were found in low bushes. Four that were obtained from this group were adults. This suggested that possibly adults and young in the fall flock separately (Swarth, MS).

In the morning of July 8, 1924, a flock of close to twenty grosbeaks flew over the camp two miles west of Black Butte. A shot was fired and the birds instantly descended, to perch scattered out in the tops of the tall trees.

On May 11, 1927, near Mineral, five evening grosbeaks were seen to alight, giving many strident calls, in some lodgepole pines. The birds at once became quiet, hopping out individually onto live branches, apparently seeking the needle buds; presently they all flew off, again calling.

Near Termo, four miles southwest of McDonald Peak, in early October, 1924, evening grosbeaks and robins were feeding in numbers upon juniper berries (fig. 60). That year only one tree in each hundred junipers bore fruit. When the fruits began to ripen and fall to the ground the birds, one or two evening grosbeaks to each half-dozen robins, went to the ground and eagerly picked up the berries. The birds that were collected here were excessively fat.

A young evening grosbeak, bob-tailed and unable to fly more than a meter, was found at Mineral camp site, June 23, 1928. A rasping cry from it brought an old male down to the ground from the tall firs overhead. (No female was seen.) The male gave the regular "location" call of the species repeatedly, and flashed its brilliantly patterned plumage effectively, captivating to the eye of the observer. Wisps of down on the "corners" of the young bird's head gave it a curious "horned" appearance. Despite its immaturity, the strikingly contrasted color pattern was already in evidence. It was left perched in a little cedar, where it still showed up conspicuously from some distance. It was probably only by accident that the young bird came to notice on or even near the ground. Five birds, part of them full-grown young, were noted flying noisily at mid-height of the large trees along the trail toward Broke-off Mountain, July 3, 1928.

Although this species was recorded in the section rather frequently, it is likely that the total population is much smaller than the number of recorded occurrences would seem to indicate. The birds are so conspicuous in both movement and voice that they almost force attention toward them when an observer is anywhere near them. For a widely wandering species, gregarious, and dependent, in winter at least, upon a food source that must be sought for far and wide according to year and place, these features of conspicuousness might prove vitally serviceable.

The series of eleven evening grosbeaks from the Lassen section proves to include specimens which lead us to a change of opinion as to the tenability of a separate race, *californica,* in the Sierra Nevada (see Grinnell, 1917, pp. 17–22). In other words, a study of this new material together with the collection of *Hesperiphona* at hand from other sources, results in discounting the value of nearly all the characters supposed to differentiate *californica* from *brooksi,* described from British Columbia. Since the latter name has sequence priority in the article cited, and since all the evening grosbeaks from the entire Pacific coast range of the species seem now best regarded as of one subspecies, the application of the name *brooksi* is hereby extended accordingly.

As to the specimens found now to be of critical significance, there are four of them (nos. 46001–04), two males and two females, adults in the midst of the annual molt, taken September 2, 1925, at Kelly's.

These birds must have been on, or very close to, their breeding ground; no autumnal wandering is likely as yet to have been undertaken. The molt stage is such that, side by side, there are exhibited on these birds new, perfectly unworn feathers, and old, abraded and faded feathers. In the males, on the head, dorsum, and lower surface the new feathers are distinctly sooty in tone (one of the characters ascribed to *brooksi*), while the old feathers are variously brown or yellowish brown (as was thought to characterize *californica*). The same sort of difference is shown in the females. In other words, sooty tones in the fresh fall plumage are gradually displaced on each individual toward the following midsummer by brownish tones.

As to width of frontal yellow band in the male, there does seem to be a tendency for California birds to have narrower bands. But this is so much a matter of averages that it does not constitute a diagnostic character for practical use.

The relative thickness of bill, also ascribed as a subspecific character, now seems less dependable. And in this connection, the four birds in the midst of feather molt show something of remark, namely, a process in progress, of peeling off, from the beak, of thin outer layers of horny sheath. Some layers appear on the verge of detachment, edges free; and the portions thus flaking off show significant symmetry in position and outline.

Now if a superficial delamination of the horny bill-sheath takes place at molt time in the autumn, this would inevitably affect relative slenderness of the bill. Material is lacking to demonstrate this as a fact; but at least the suggestion is strong. In subsequent geographic studies of *Hesperiphona*, this factor will have to be considered.

Carpodacus purpureus californicus Baird

California Purple Finch

Found by us in summer on the western slope of the mountains from Payne Creek P. O. east to Mineral; seen in winter as low as Dale's. Specimens preserved from following stations: Dale's, 600 feet, December; Payne Creek P. O., 1600 feet, December (observed also in June); Lyman's, 3300 feet, June; Battle Creek Meadows, 4800 feet, May. Observed also at the following places: Manton, 2300 feet, April; Mineral, 4900 feet, May to July.

Townsend (1887, p. 215) took a single individual, June 1, 1884, "at the eastern base of Mount Lassen"; the exact locality cannot now be determined.

Two adult males collected in December weighed 22.5 and 25 grams. One in May weighed 20 grams. An adult female collected in December weighed 25.8 grams; one in June, 22.5.

At Manton this finch was found frequenting digger pines in April. Near Lyman's one that was observed flew up from a manzanita bush and perched three meters up in a pine tree. Many were found in summer in the black oaks near Payne Creek P. O. In December near Dale's this bird was found in the valley oaks along the stream. In the same month at Payne Creek P. O. flocks were seen in cascara bushes along a stream bed, and single birds were seen in blue oaks and bushes of buck-brush.

At 10:30 A.M. on December 23, 1927, numbers of purple finches were encountered bathing in the shallow seepage pools on the mesa near Payne Creek P. O.

During one midsummer season a male purple finch had formed the habit of visiting daily a camp site near Mineral. It would come to an eating table and hop around on the ground beneath and around it, picking up particles of food. Once, a lone female came to the camp. The male would sometimes come as near to a person as two meters, but the female never came nearer than five meters.

Near Mineral in late July, 1925, when amelanchier berries were turning reddish, though they were not yet ripe, they were eagerly sought by the purple finches.

The summer metropolis of this purple finch appears to lie within the Transition life-zone.

Carpodacus cassinii Baird

Cassin Purple Finch

Recorded in the section from Battle Creek Meadows eastward to the vicinity of Eagle Lake; in winter found as low as 3500 feet altitude on the west side of the mountains. Collected at the following stations: Battle Creek Meadows, 4800 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Spalding's 5200 feet; Gallatin's 5200 feet. Observed at following additional localities: eleven miles east of Payne Creek P. O., 3500 feet (December 21, 1927); summit of Turner Mountain, 6300 feet; Mineral, 4900 feet; Soupan Springs, 7000 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Prospect Peak, 8340 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Pappoose Valley, 5200 feet.

Weights in grams of four adult males collected in summer were: 25, 28, 28.7, and 29. Weights of four females collected in summer were 26, 27, 27.2 (juvenal, not quite fully fledged), and 29.3. A fully fledged young female collected in September weighed 30 grams; an adult female in October, 27.

This finch was found in loose companies or singly, on the ground or in tree tops, usually in rather open forest growths. Activity of one sort or another was definitely noted in types of trees exemplified by the following: white alders along streamlet, aspen, lodgepole pine, yellow pine, hemlock, small red fir. These trees were used for singing and resting perches and sometimes as foraging places, while a greater share of the foraging for food took place on the ground in clearings or at the edges of forest bordering large meadows (fig. 64). Individuals were often seen hopping about on the ground of camp sites, sometimes picking up bits of something from spots where ashes were scattered. This was the most abundant bird about the fire station on the summit of Prospect Peak, where Mr. A. H. Kramer, the lookout there, regularly fed the birds at his doorstep. Upwards of a dozen, all adults, were seen congregated there at one time on June 28, 1928.

A Cassin purple finch was shot, August 1, 1925, from high in a hemlock above Lake Helen (fig. 10). The bird's gullet was filled with the shelled kernels of two kinds of seeds, but no animal matter was detected.

A review of all the field notes gathered by us leaves the impression that the center of the summer metropolis of this purple finch lies within the red fir belt, in other words, within the Canadian life-zone.

On June 11, 1929, at the edge of Pappoose Valley a group of eight or more individuals was frightened from the floor of a tumbled down log cabin. The birds soon returned and perched on the roof.

Henshaw (1879, p. 294) records that, in July, 1877, he "found communities of considerable size . . . . colonized in certain parts of the pine woods about Eagle Lake . . . . "; and he comments upon the proneness of this species to "crowd into a certain neighborhood . . . . to the total disregard of others which, perhaps, appear no less suited to their economy."

Near Bogard R. S., on June 21, 1929, a female was watched building a nest fifteen meters up in the end of a branch of a large yellow pine at the edge of the meadow. The bird foraged on the ground for nest material.

Carpodacus mexicanus frontalis (Say)

California Linnet

Found on the western slope of the mountains as far up, though rarely so far, as Battle Creek Meadows, and in the eastern portion of the section from the middle shores of Eagle Lake eastward (fig. 115). Specimens represent the following localities: Red Bluff, 300 feet; Coyote Creek, 270 feet; Bloody Island, 350 feet; Dale's, 600 feet; Box Springs, 5300 feet. Observed at following additional localities: Blue Tent Creek, 300 feet; Sisson's, 270 feet; Cone's, 270 feet; Mill Creek, 260 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet (June 8 and 14, 1924); Battle Creek Meadows, 4800 feet (June 22, 1924); Spalding's, 5200 feet; north end of Eagle Lake, 5200 feet; Grasshopper Valley, 5700 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet.

Three males collected in May in the western end of the section weighed 17.5, 20.8, and 22.9 grams. An October-taken male from Box Springs weighed 20 grams. Two males collected in December in the western part of the section weighed 20 and 21.3 grams. Weights of two females from the western end of the section collected in May and January were 21.2 and 22.3, respectively.

In the lower, western part of the section linnets chose to frequent such widely varying situations as the following: in valley oaks and on the ground surrounding them; in cottonwoods along streams; in blue oaks where closely growing on hills, and where scattered over a rocky mesa; in chaparral on digger-pine-covered slopes; in fields of alfalfa and other cultivated crops; in orchard; in vegetation of fence rows; in roadside vegetation; on bare areas of ground near buildings; on and about buildings or groups of buildings. In the eastern portion of the section linnets occupied situations which differed, at least in appearance, from those characterized above. Where linnets were found east of Eagle Lake they were in surroundings such as the following: in vegetation of a marsh; in irrigated fields and hay meadows; in weed-covered deserted fields; in planted groves of cottonwoods; in aspens; in scattered junipers amid sage-brush; in dead and living bushes on rocky ground; on rocks of cañon walls; close to buildings.

The two ends of the section differ in the size of the human populations which they support; there are many more man-made structures in the western than in the eastern end. These buildings, bridges, walls, and the like, usually present features which apparently fulfil some of the habitat requirements of the linnet quite as well as do the cliffs and rocky crevices which were doubtless used most frequently before the region was settled.

This finch, it seems, can inhabit localities where there are almost no trees, possibly because it is able to use crevices in cliffs and boulders for nest locations. At the same time, the species retains the tendency to nest in trees when these are available. The natural inclinations of the birds are such, then, that they would readily make use of many of the man-made structures that are reared in a region with the process of human settlement.

At Manton in late May, 1926, linnets in an orchard were feeding on mulberries and cherries. Usually the feeding birds were on the ground. A group was watched as it fed, April 15, 1928, on the ground beneath a blue oak north of Red Bluff. At frequent and regular intervals the whole group would fly hurriedly to near-by trees, as if to escape a threat of danger, only to return shortly to the ground. A search by the observer disclosed no thing discernible to him that might have stimulated the birds to behave in such a way. The impulse to leave seemed to be supplied by the birds themselves or at least by some of them, which would then be followed by the whole group (Linsdale, MS).

Eight miles southwest of Ravendale, July 19, 1928, hundreds of linnets were congregated about some springs in a small cañon. A large proportion of the birds were perched in dead bushes, sometimes twenty-five or thirty individuals on the branches of one bush. It was thought that the birds picked these open perches in order to get the benefit of the warm sunshine.

On April 5, 1928, linnets singly and in small groups were abundant in the blue oaks north of Red Bluff. All were noisy. One pair was seen, the male of which was going through antics of courtship, fluttering back and forth on its perch and singing, with spread tail and drooping wings.

Another male was performing, singing and turning with spread wings and tail, before a female at Coyote Creek on April 17, 1929. The female reached out at frequent intervals and pecked at the male which, each time, hopped just out of reach, then returned almost immediately.

A nest under construction was found, April 15, 1928, six miles north of Red Bluff. The structure was five meters above the ground on a nearly horizontal limb of a blue oak. The female of the pair carried material and the male always accompanied her but was seen to do no work. On the same day another nest, partly built, was seen six meters up on a leafy limb in a clump of live oaks, the nest nearly hidden by the leafy twigs. Here, too, the female did the work, although once the male was seen with a grass stem which, however, it did not take to the nest.

On May 25, 1926, at Bloody Island, a pair of linnets was seen, the female of which carried straw to an unfinished nest, five meters above the ground, in a vine growing over a tree.

On June 9, 1929, in Petes Valley a nest was seen one and one-fourth meters up and placed on a board in a corral fence. It contained four eggs. Another nest was being constructed near the top of a tall cottonwood. Two nests were seen in the end boughs of junipers at the edge of the valley. The linnets from various parts of the valley came to the group of cottonwoods about the house where they spent much time. Close to forty individuals were counted in these trees at one time.

A nest containing four eggs was found, July 15, 1928, near Petes Valley. The nest was two and one-half meters above the ground on a horizontal limb of a juniper standing alone on the high ground of a mesa. Both adults came close to the tree and called.

Three small young linnets occupied, June 18, 1928, a nest two meters up in a dense, small juniper spire at the north end of Eagle Lake. Another nest close by in a similar situation also contained three just-hatched young. These nest trees were surrounded by nearly pure stands of sage-brush.

As regards life-zone, the linnet, in our section, adheres rather closely to the Upper and Lower Sonoran.

Acanthis linaria linaria (Linnaeus)

Common Redpoll

A male and female are in the Museum of Vertebrate Zoology that were collected November 30 and December 13, 1899, respectively, part of a series of forty specimens taken "near Eagle Lake" by J. M. Willard. This collector has recorded (1902, p. 45) encountering large flocks almost daily in pines, sage-brush, and brush along streams, the earliest November 30, the last, December 23. Apparently, this boreal bird visited northeastern California in 1899 in considerable numbers; and, interestingly, the above remains to date the only record for the state.

Spinus pinus pinus (Wilson)

Northern Pine Siskin

Found by us in the section as high as 8000 feet and as far eastward as Petes Valley. Localities represented by specimens are: Elliott's, 1000 feet, December (also observed, April 14, 1928); Manzanita Lake, 6000 feet, June; two miles west of Black Butte, 6800 feet, July; Eagle Lake Resort, 5200 feet, June 16. Observed also at the following places: six and ten miles north of Red Bluff, 500 feet, April; Antelope Creek at 400 feet, April 11, 1928; four miles southeast of Manton, 3100 feet, April 21, 1928; Battle Creek Meadows, 4800 feet, July; Mineral, 4900 feet, May and June; Broke-off Mountain at 8000 feet, July; above Soupan Springs, 8000 feet, August; Kelly's, 5200 feet, September; Butte Lake, 6100 feet, June; Bogard R. S., 5500 feet, June; Petes Valley, 4500 feet, June 8, 1929.

Two females, collected December 25, weighed 11.2 and 12.2 grams. June and July collected females weighed 13.5 and 13.4 grams, respectively.

In summer, siskins were observed in the tops of hemlocks, firs, and pines, sometimes in willow thickets. Many times they were seen on the ground in trails, at the edges of meadows, or around the borders of lakes, where they foraged among the low-growing herbs.

In winter, siskins in the western part of the section were, along with other finches, in the willows and in weed patches in vacant fields. Later in the season, in April, while the birds were still in the lowlands, flocks were feeding in the tops of blue oaks, live oaks, and a little higher, in yellow pines and black oaks.

At Mineral, May 30, 1927, a pair of siskins was feeding on the ripening seed-heads of dandelions near a cabin.

Two individuals that were seen June 7, 1929, in the group of cottonwoods in Petes Valley were thought to be vagrants.

Spinus tristis salicamans Grinnell

Willow American Goldfinch

Found regularly as resident on the western slope of the section as far up as the 1000-foot contour line; recorded once from the vicinity of Eagle Lake. Specimens were obtained at the following places: Red Bluff, 300 feet; Cone's, 270 feet, December; Mill Creek, 260 feet; Dale's, 600 feet, December; Elliott's, 1000 feet, December; Spalding's, 5200 feet, October. Observed also at Blue Tent Creek, 300 feet, and Silva's, 270 feet.

There are in the California Academy of Sciences two specimens (nos. 4288–89, coll. J. and J. W. Mailliard) taken by J. M. Willard at or near Eagle Lake, October 12, 1899. These have been examined and found to belong to the race *salicamans* rather than to the Rocky Mountain form *pallidus* as was suspected.

Three males collected in December in the western part of the section weighed 13.2, 13.2, and 13.5 grams. Six females of same data weighed 10.3, 11.1, 11.4, 11.6, 12.1, and 13.4 grams. A male and two females, collected at Red Bluff in early May, weighed 13.1, 12, and 13.2 grams, respectively. A male from Spaldings, October 18, weighed 11.8 grams.

This goldfinch was often seen perched in willow or sycamore trees near the streams. It was also seen in the tops of valley oaks and even in blue oaks. In December, 1927, large flocks were found feeding in fields at Cone's, that were covered thickly with tall dead composite "weeds" (*Centaurea*). When alarmed, the birds sought safety in the scattered valley oaks. Each flock contained about seventy-five individuals. At this place some of the birds fed in trees and some on the ground.

A flock of from twenty to twenty-five birds was seen April 24, 1928, in a sycamore at the edge of a stream at Cone's. Some of the males were singing. Another flock of approximately fifty individuals was seen early in the morning of May 1, 1928. These birds were on the ground or perched on telephone wires at the side of the highway south of Red Bluff.

On May 8, 1924, a nest of the willow goldfinch was found in a small blue oak on a dry ridge north of Red Bluff and at least a mile from the Sacramento River. A solicitous female, accompanied by a male, was at the nest. The situation of this nest was exceptional; the subspecies is, as a rule, in California, restrictedly riparian.

A nest was found, June 12, 1912, near the Mill Creek collecting station. It was close to the bank of the Sacramento River. The nest site was in a crotch of a small buck-brush bush. Attention of the observer was directed toward the nest by the young birds suddenly flying when the nest was approached. A considerable accumulation of droppings was noted around the edge of, and even within, this nest. The parents were not seen.

A young bird being fed by an adult female was seen, May 25, 1926, three meters above the ground in a willow close to the river at Bloody Island.

Spinus psaltria hesperophilus (Oberholser)

Green-backed Arkansas Goldfinch

Found by us in the western part of the section in summer as high as 6800 feet and in winter as high as 1000 feet; also at three places in the eastern part of the section. Specimens were preserved from the following stations: Red Bluff, 300 feet; Cone's, 270 feet, December; Bloody Island, 350 feet; Dale's, 600 feet; Elliott's, 1000 feet, December. Observed also at the following additional localities: ten miles north of Red Bluff, 500 feet, April; Blue Tent Creek, 300 feet; Mill Creek, 250 feet; Payne Creek P. O., 1600 feet, April and June; Manton, 2300 feet, April, May, and June; Lyman's, 3300 feet, June; Battle Creek Meadows, 4800 feet, June; Mineral, 4900 feet, July; two miles west of Black Butte, 6800 feet, June 28 and July 2; Potes Valley, 4500 feet, July; eight miles southwest of Ravendale, 5600 feet, July; Secret Valley, 4500 feet, June.

Four males collected in May weighed 8, 8.5, 8.7, and 10.5 grams. Two May-taken females weighed 8.2 and 10.3 grams. Two December-collected males weighed 9.6 and 9.8 grams; two females, 8.4 and 9.1.

This species was found most frequently in blue oaks. Other trees that were frequented were live oak, valley oak, sycamore, cottonwood, and willow. Sometimes the birds were seen in bushes such as buck-brush. Telephone wires furnished perches that were used often.

In winter the birds were observed, in flocks, feeding in trees and, more frequently, in weed patches in unplowed fields. About twenty individuals in one company were eating seeds of *Centaurea* at Cone's, December 29, 1927.

On April 23, 1928, several mated pairs of this goldfinch were seen among the blue oaks on the hills six miles north of Red Bluff. An unfinished nest was seen one and three-fourths meters above the ground in a shrubby blue oak at the edge of a small clump. The birds had selected a site on a limb sloping at a forty-five degree angle and near the center of a spindling shrub. The nest appeared to be made almost entirely of sheep's wool. The female was on the nest shaping it, meanwhile keeping up a twittering call. Another nest like this one was seen at the side of the road.

A mated pair was shot on May 25, 1924, at Dale's, the female of which had laid part of a set of eggs.

A brooding female, on June 12, 1912, was flushed from a nest one and one-half meters up in a terminal bunch of foliage of an oak. The nest was built of plant fibers and was lined with sheep's wool, fibers from cottonwood seeds, rabbit-fur, and horsehair. Three eggs were in the nest. The female remained in the vicinity and gave call-notes, but no male was seen.

Evidence of the post-nest-season movement of this species up into the higher mountains was noted as follows. In 1924, at Battle Creek Meadows on June 22, one was seen drinking water from a ditch. On June 16, 1927, one perched in an aspen in that locality, and sang there, before resuming flight. In July, individuals were seen in that neighborhood still more often.

Where green-backed and willow goldfinches were foraging in winter in the same weedy fields, even in close proximity, the individuals of the two species on taking flight formed separate companies and kept apart until, when re-alighting, chance might bring them together again.

Loxia curvirostra bendirei Ridgway

Bendire Red Crossbill

Specimens were obtained by us only on Broke-off Mountain at 9200 feet. Observed also in following localities: Mineral, 4900 feet; Lake Helen, 8200 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Feather Lake, 5500 feet; Eagle Lake Resort, 5200 feet.

A male collected July 27, 1925, weighed 29.6 grams.

Crossbills as observed were usually flying in small flocks. When seen perched they were in yellow pines, lodgepole pines, red firs, and hemlocks.

The male that was shot on Broke-off Mountain, July 27, was with at least five other crossbills, probably a family group, scattered about in the tops of closely adjacent hemlocks. The trees were loaded with green pendant cones, and it was thought at the moment of discovery that the birds were feeding on seeds from the cones; but examination, later, of the contents of the stomach of the bird taken proved that the only food was a smooth, bright-green caterpillar. Thirteen of these caterpillars, uniform in size, 12 to 17 millimeters in length, were found in the one bird.

On August 1, 1925, a mixed flock containing both crossbills and Cassin purple finches was observed above Lake Helen. On the same day, a little lower down toward Soupan Springs, a sequestered pair of crossbills was seen in the top of a small hemlock, the male of which sang protractedly, reminding the observer of the song of a green-backed goldfinch in variableness but with the component notes louder and sharper; the whole not so sadly melodious, though still pleasing to the human ear. This observation suggested that crossbills might be nesting at this time and place (Grinnell, MS).

Sheldon (1907, p. 189) records finding two large flocks at Eagle Lake feeding in maple trees. A series of specimens was taken, ''varying in plumage''; and two of these are now in the Museum of Vertebrate Zoology, adult male and female, each in much worn plumage, both taken July 10, 1905.

In the summer of 1884, Townsend (1887, p. 216, and MS) found crossbills numerous and easy to obtain ''in the pine region east of Mount Lassen.'' Here they ''were nearly always to be found in three particular localities in the vicinity of springs, and seldom anywhere else.'' In one place, at a cabin, ''it was their custom to come to a stump before the door early in the morning, often half a dozen being on it at once. . . . . '' The attraction at this stump was believed to be salt, as that was where horses were ''salted.'' Another place frequented by them was at Bridge Creek, ''on the trail leading from Mount Lassen to Susanville.'' Here the birds appeared each day, being especially active at morning and evening, and perching in ''tamaracks'' (lodgepole pines). Both old and young were present. Specimens were taken at these different places June 7, 11, 14, 17, and 23, and July 1.

Groups of from ten to twenty-five individuals were seen frequently in the coniferous forests of the section in April and June, 1929.

Oberholseria chlorura (Audubon)

Green-tailed Towhee

Found in summer generally distributed over the section east from Battle Creek Meadows and below 8000 feet altitude. Collected at: Mineral, 4900 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet. Observed also at the following additional places: Battle Creek Meadows, 4800 feet; Turner Mountain, 6300 feet; two miles west of Black Butte, 6800 feet; Wilson Lake, 5100 feet; Warner Creek at 8000 feet, September 10, 1923; Willow Lake, 5600 feet; Spalding's, 5200 feet; north end of Eagle Lake, 5200 feet; eight miles southwest of Ravendale, 5600 feet; Termo, 5300 feet; Jones', 5400 feet.

A male collected July 29 weighed 26.7 grams; two males, June 7, 26.5 and 28.1; a female, June 20, 28.6 grams.

This species, within the section, was found on dry, brushy slopes. The plants with which it was particularly associated were, in the mountainous part, manzanita and snow-brush; in the Great Basin portion, sage-brush and *Purshia*. In these bushes or on the ground close to or beneath them the birds spent most of their time. Occasionally, one would go higher, so as to be on some favorable perch for singing, as, for example, on a branch of a small tree surrounded by chaparral.

In the mountains, forest was taboo; in the eastern, Great Basin territory, level brushlands were avoided. The type of habitat chosen seemed to include the factor of rather sharply sloping terrain, where this was clothed with bushes of low, spreading contour.

The song of the green-tailed towhee was characterized by one observer as a "set" song, though it was rarely repeated more than once in just the same form. The birds constantly varied the order of a few simple elements. One form, an unusually simple example, that was noted was *cheh, chee-chee, cheh.* Another song taken down just as it was sung was *seeyuh, suhthee suh-th 'th 'th.* The order of the elements was next varied, much as follows: *suh-thee suh-th'-th'-th;* and again: *see suh thee suh-thuh-thuh-thuh.* Alarm notes were given by this bird in a high mewing voice: *mair-wep* or *maeu-wêh;* sometimes a single short, inquiring *maeu?* One individual interspersed his mewing with constant, scarcely noticeable, sharp, fine, chipping-sparrow-like *chips* (Hunt, MS).

Late in July, 1925, when berries of amelanchier bushes near Mineral were turning reddish but were not yet at all ripe, the green-tailed towhees were seeking these eagerly and eating them.

An individual of this species was seen, April 19, 1929, apparently established for the summer on its nesting ground on a chaparral-covered slope near Mineral.

On June 15, 1927, near Mineral a brooding bird was flushed from a nest containing three well-incubated eggs. The nest was in a mass of slanting snow-brush stems in a dense thicket of the same just coming into bloom. Its rim was 55 centimeters above the ground.

A nest containing three fresh eggs was found at Mineral, June 25, 1925. It was well up, 59 centimeters from ground to rim, in a clump of snow-brush surrounded by small lodgepole pines. The nest was of small bulk, made entirely of slender stuff, pine needles in the base, then small plant stems, and lined with horsehair. Leafy branches of the snow-brush extended at least one-half meter above the nest, so that it was well shaded. The one bird seen near by showed unmistakable concern, coming close to the intruder and raising the feathers of the conspicuous red-brown cap. No bird was seen near the nest after it was first discovered, so evidently it was deserted. The eggs when collected and blown three days later proved to be not incubated.

Young were found earliest, near Mineral on June 20, 1925, when a nest, containing three young one-third grown, eyes open, and alert, but with down still predominating, was discovered halfway to the top of a clump of snow-brush. The nest rim was 52 centimeters above the ground. The support was made up of slanting stems and appertaining fine twigs of the bush. The mass of the nest was slight; it lacked a loose, coarse basal layer; and the wall was rather thin yet compact.

A nest which held four young was seen, July 4, 1924, two miles west of Black Butte. The nest was 30 centimeters above the ground in a clump of snow-brush on top of a ridge covered with snow-brush and manzanita. The feathers on the nestlings were just beginning to show. An adult at the nest when approached ran over the ground for a considerable distance before taking flight. It was joined by its mate and both called nervously from near-by bushes.

Eggs were found on as late a date as July 19, 1925, when an adult was flushed from three eggs in a nest near Mineral. The structure was 92 centimeters above the ground, near the southern edge of a large clump of snow-brush. By July 26 the three eggs had hatched and there were young. The nest was empty on August 3.

A family group of adults and bob-tailed young was seen, July 18, 1928, near the top of a ridge eight miles southwest of Ravendale. Most of the birds seen on that day were alone or in pairs. Several were heard singing. A young towhee just out of its nest was seen near Jones' on July 25.

Pipilo maculatus falcinellus Swarth

Sacramento Spotted Towhee

Resident in the western part of the section as far up the slope as the 3500-foot contour line (fig. 104). Larger numbers present, and more widespread locally, in winter than in summer. Skins were saved from the following places: six miles north of Red Bluff, 400 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; south face of Inskip Hill at 1800 and 2000 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; eight miles east of Payne Creek P. O., 2800 feet. Places where this bird was observed but not collected are: Coyote Creek, 270 feet; Silva's, 270 feet; Tehama, 250 feet; Elliott's, 1000 feet; Inskip Hill, to summit, 3000 feet; Lyman's, 3300 feet; eleven miles east of Payne Creek P. O., at 3500 feet.

Weights of four males collected in May were 39.9, 40.2, 40.2, and 41.6 grams. A May-taken female weighed 43.2 grams. Weights of twelve males collected in midwinter ranged from 36.4 to 44.4 (average 41.1) grams; nine females, 37.3 to 44.7 (average 40.6).

The spotted towhee showed marked preference in all seasons for dead bushes and accumulations of dead brush and trash close to the ground, even where green-foliaged bushes were easily available. Probably the characteristic manner of foraging employed by this species produces better results in situations whose locations are indicated to the human observer (possibly, also, to the birds) by dead brush. In such places are usually found greater accumulations (fig. 56) of decaying organic matter than could be found elsewhere. When the birds foraged under green bushes this was usually where there were, in more than ordinary amount, accumulations of dead leaves.

On December 27, 1927, the belt of scrub oak on Inskip Hill was found to be liberally inhabited by spotted towhees. Between the oak clumps the ground was bare, grassless, just pumice pebbles, but beneath the clumps, the ground level was raised by deep porous accumulations of leaf litter, and in these the towhees were vigorously scratching. On December 23, in a creek bottom near Payne Creek P. O., many individuals were seen scratching in the litter of black oak leaves where they were conspicuous in the absence of cover. These observations help to confirm the idea that in the case of this bird the type of litter may be more important in determining the forage ground, than type of cover.

In December, 1924, when the whole western end of the section was covered with snow, the towhees concentrated to scratch and dig in the nearly snow-free areas directly beneath thick oaks and beneath dense bushes of buck-brush. In such places the birds scratched so vigorously that litter was spread from 15 to 45 centimeters over and past the edge of the snow.

Foraging birds, out of sight in thickets, often ''give away'' their identity by giving at frequent intervals the call characterizing the species. However, some of the birds that were watched with this point in mind failed, over a period of several minutes in each case, to make any sound other than the mechanical one produced in scratching.

Spotted towhees were seen in or about plants of the following kinds: grapevine, buck-brush, scrub oak, manzanita, poison oak, cascara, willow, live oak, blue oak, black oak, and digger pine.

In the spring it was regular for the males to sing from perches several meters above the ground in trees, often in dead ones. Even in winter, individuals or small groups of two or three were sometimes seen perched quietly in the tops of trees.

Adult males and females shot on May 19, 1924, in the vicinity of Dale's showed on examination that they had not yet started nesting. On May 27, 1926, at Bloody Island, a family group of young towhees just out of a nest was flushed from a brushy thicket at the edge of a grove of valley oaks.

Pipilo maculatus curtatus Grinnell

Nevada Spotted Towhee

Found by us in the eastern part of the section in the fall only, except at Secret Valley where the species is resident in summer at least (fig. 104). One record on the western slope is for a wintering bird. Specimens obtained at the following localities: Payne Creek P. O., 1600 feet, December 22, 1927; Spalding's, 5200 feet, October 13 and 14, 1923; five miles north of Fredonyer Peak, 6000 and 5700 feet, September 29 and October 2, 1924; Termo, 5300 feet, October 12, 1924; Secret Valley, 4500 feet.

Weights of males collected in early fall were: 31.5, 40.1, 42.4, and 45.2 grams. A female collected in October weighed 28 grams; one in December 37.3.

At Spalding's, on Eagle Lake, it was noted (Dixon, MS) that where no spotted towhees had been seen on the previous day, six were noted during a two-hour period on October 14 (1923). It was thought that a migration ''wave'' was passing.

On June 16, 1929, many pairs of spotted towhees were seen in Secret Valley. The birds were inhabiting the willow thickets and other brush near the stream in the valley. The one nest that was found was on the ground in the center of a clump of rabbit-brush. Its rim was 15 mm. above the ground level. Inside diameter at the rim was 75 mm. The female, brooding four eggs, flew off when approached to within two meters. The nest was made chiefly of shreds of bark and was lined with fine grass. On one side, between two stems of the bush, was a sort of runway of material such as composed most of the nest. Apparently all the sticks and grasses had been carried in over this one path and some loose ends had been left, thus forming an approach.

Pipilo fuscus carolae McGregor

Sacramento Brown Towhee

A resident in the western part of the section and occurring as far eastward as Manton. Collected at the following stations: Red Bluff, 300 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet. Observed also at the following additional localities: six miles north of Red Bluff, 500 feet; Blue Tent Creek, 350 feet; Silva's, 270 feet; Elliott's, 1000 feet; Payne Creek P. O., 1600 feet; four miles west of Turner's, at 2800 feet.

Weights of four males, collected from May 2 to June 1, were: 52.6, 56.4, 56.4, and 56.7 grams. Two females taken in late May weighed 55.4 and 58.9 grams. Four December-collected males weighed 52.9, 58.5, 62.5, and 62.8 grams. Six females in December weighed: 50.2, 51.5, 52.7, 54.3, 54.5, and 58.9 grams.

This towhee foraged on the ground, chiefly in the near neighborhood of dense shrubby thickets. These favorable situations were found on river and creek plains, at the edges of fields and orchards, or at the borders of clumps of trees. Individuals were seen often perched quietly off the ground in bushes or in low trees, always conveniently near to forage places.

In April the towhees were observed in pairs, usually. One was seen at Cone's carrying a straw on April 6, 1928. Near Dale's on May 20 and 22, 1924, brooding females were collected. On May 25, 1926, an adult accompanied by a young bird with feathers not completely grown out was observed near the Sacramento River. Three not fully grown young were collected at Mill Creek, June 10, 12 and 13, 1912.

Richard Hunt (MS, under date June 4, 1924) records that at Dale's he heard a brown towhee giving "habitually, the same type of song" he had recorded of birds elsewhere as worthy of special remark (see Hunt, 1922, p. 193, and 1923, p. 134). "This," he says, "was the ninth song of this type that has come to my attention since I wrote the first paper. It would seem that this vocal 'mutation' is more wide-spread among individuals of *Pipilo crissalis* than I imagined. This particular song was: *tip-tip, treh-treh-treh-treh-treh-treh,* *tip-tip-tip.* The whole utterance lacked the force and clanking sharpness usual to the song of this species. . . . . The bird was visible in a willow . . . . and I heard it repeat this song in exactly the same way over a dozen times."

Passerculus sandwichensis sandwichensis (Gmelin)

Aleutian Savannah Sparrow

Found by us only in mid-winter in the western end of the section. Specimens were obtained at points ten miles north of Red Bluff, 500 feet, near Coyote Creek, 270 feet, and two and one-half miles east-northeast of Tehama, at 400 feet.

Two males and two females collected in mid-winter weighed 23.6 and 25.9, and 23.9 and 22.5 grams, respectively.

On December 28, 1927, a bird of this race obtained was foraging alone at the edge of a prairie rain-pool near Coyote Creek.

On January 6, 1929, on the barren rolling prairie land two and one-half miles east-northeast of Tehama, three Aleutian Savannah sparrows were found where the exceedingly sparse patches of dry grass here and there afforded only partial cover. When come upon, the birds *ran* to one side, loath to take flight. In behavior, appearance, and habitat they showed seemingly marked differences from *alaudinus.* In *sandwichensis* the relatively large size was apparent, and the dark and light stripings on sides of head and on back showed more contrastingly. A half-mile away, at the margin of the bottomlands, *alaudinus* was present in droves in the heavy dead grass and star-thistle, from which the birds flushed readily, shortly to dive down out of sight again into the dense cover. No *sandwichensis* could be detected there.

Passerculus sandwichensis anthinus Bonaparte

Kodiak Savannah Sparrow

A winter visitant to the western end of the section. Seven skins out of the Savannah sparrows taken December 28, 1927, to January 2, 1928, ten miles north of Red Bluff, 500 feet, and at Coyote Creek, 270 feet, belonged to this race.

Weights of two males were 21.2 and 21.8 grams; two females, 18.4 and 18.7.

One individual was shot from a group of eight or more Savannah sparrows in a small blue oak close to a stream on the open prairie. The remainder of the company flew to the ground at a place where the grass was tall enough for concealment.

Passerculus sandwichensis alaudinus Bonaparte

Western Savannah Sparrow

Numerous in winter in the Sacramento Valley and on adjacent prairie land, occurring also at times of migration widely, clear to the eastern end of the section. Judging from the proportions in the Savannah sparrows collected (twenty-six out of thirty-nine winter skins proved to be *alaudinus*) this race made up the bulk of the fall, winter, and spring population of this species in the section.

Localities represented by specimens are the following: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Coyote Creek, 270 feet; Cone's, 270 feet; near Tehama at 350 feet; Spalding's and north end of Eagle Lake, 5200 feet, October 18, 1923, and September 28, 1924; five miles north of Fredonyer Peak, 5700 feet, October 2, 1924; Box Springs, 5300 feet, October 18, 1924.

Five males from the western part of the section in midwinter weighed 17.8, 18.2, 18.2, 18.9, and 21.4 grams. Weights of eight females of same season and place ranged from 16.4 to 19.1 (average 17.7) grams. Four females from the Sacramento Valley in early May weighed 15.8, 17.4, 17.9, and 20 grams. The last weight was from an especially fat bird. In the eastern part of the section: a female, September, weighed 15 grams; two females, October, 15.7 and 18.1; a male, October, 16 grams.

Recorded in spring as late as May 7 (1924, near Red Bluff); in fall as early as September 28 (1924, at north end of Eagle Lake). On the mesa north of Dale's, where no Savannah sparrows were to be found in midwinter, they were numerous in April (noted definitely on three days from April 14 to 25, 1928).

Savannah sparrows foraged during the winter in small companies scattered through grass or weed patches usually not far from water in some shallow ditch, stream, or rain-pool. Sometimes when disturbed the birds would fly to a perch off the ground either on a fence wire or in some small tree. At other times they would run along sheep trails through the grass for some distance before taking flight. On December 28, 1927, a windy day, at Coyote Creek, the sparrows were scattered and difficult to see in the moving grass. They would fly up at long range, dashing this way and that at full speed from the take-off, to drop abruptly into the grass again.

Passerculus sandwichensis nevadensis Grinnell

Nevada Savannah Sparrow

A summer visitant to the eastern part of the section; recorded locally as far west as Battle Creek Meadows. Specimens were preserved from the following stations: Battle Creek Meadows, 4800 feet, June 24, 1924; Petes Valley, 4500 feet, July,; Red Rock P. O., 5300 feet, July. Also seen at other points, as follows: south end Grasshopper Valley, 5300 feet, June 18, 1928: seven miles south of Ravendale, 5400 feet; Box Springs, 5300 feet, July.

An adult male from Battle Creek Meadows, in June, weighed 16.1 grams. Two July-taken adult males from the eastern end of the section weighed 16.1 and 17 grams. Three full-fledged juvenal males from the same neighborhood, in July, weighed 15.2, 15.9, and 16.3 grams. A full-grown young female, July 11, weighed 14.8 grams.

This race in summer inhabited the grassy portions of valleys and the hay meadows, especially where the soil was moist. When disturbed the birds would flush and fly to perches on fence posts, hay stacks, tops of tall grass clumps, or back to the ground.

Singing birds were heard in the neighborhood of Red Rock P. O. as late as July 26 (1928). Most of the individuals seen in the second half of July were young just out of nests.

Ammodramus savannarum bimaculatus Swainson

Western Grasshopper Sparrow

Grasshopper sparrows were found, June 25, 1924, in a grass covered area in Battle Creek Meadows, 4800 feet. Several singing birds were heard and three specimens were obtained. When disturbed, one of the birds perched one-third meter above the ground in a small willow.

A young but full-fledged individual, weight 15.5 grams, was shot, July 13, 1928, in a grass-covered, abandoned field in Petes Valley, 4500 feet. Each time the bird was flushed it lit on the ground, not on a weed or a bush as other kinds of sparrows in the same field did.

Weights of the three adults from Battle Creek Meadows, two males and one female, were: 15.8, 16.8, and 17 grams, respectively.

The song of one of the males observed in Battle Creek Meadows was described as made up of three rapid "ticks," a whir, and ended by a squeak. Another's song was said to have two "ticks or clicks" and a "toneless whir." At one time four males were singing from grass tufts within a radius of 100 meters (Hunt, MS).

The above records of occurrence are scanty, but they can be interpreted as indicating that the western grasshopper sparrow breeds locally in both the western and the Great Basin portions of the section.

Pooecetes gramineus confinis Baird

Western Vesper Sparrow

Occurs in the eastern part of the section. Specimens were obtained at Petes Valley, 4500 feet, in July, and at Box Springs, 5300 feet, in July. Observed also at: Bogard R. S., 5500 feet, June; south end of Grasshopper Valley, 5300 feet, June; seven miles south of Ravendale, 5400 feet, June; one mile west of Red Rock P. O., 5300 feet, July.

Four adults, three males and one female, July, weighed 23, 26.1, 26.3, and 23.3 grams, respectively. A fully fledged young male, July 11, weighed 22.1 grams.

Individuals of this sparrow were nearly always seen in the tops of sage-bushes. The bushes used as perches were mostly those close to flat open intervals or where there were growths of grasses or other plants along with the sage. Sometimes the birds were disturbed on the ground, whence they then flew to perches in the bushes.

Pooecetes gramineus affinis G. S. Miller

Oregon Vesper Sparrow

A single bird of this race was collected (no. 52779) ten miles north of Red Bluff, 500 feet, on April 10, 1928. Several others, likely of the same subspecies, were seen in that vicinity on different days between April 5 and 23. This bird, a female, weighed 24.6 grams.

Most of the vesper sparrows that were found in the western part of the section in April, 1928, and assumed to belong to the subspecies *affinis,* were on the ground in or at the sides of roads. Sometimes they were in grass; at other times in blue oaks. Nearly always they were in company of lark sparrows. One was seen taking a dust bath, fluttering in a road (Linsdale, MS).

Chondestes grammacus strigatus Swainson

Western Lark Sparrow

Present in summer on the western slope of the section up as far as Battle Creek Meadows, though rarely so high as this; also present in the eastern, Great Basin end of the section. In winter, occurs in small numbers from the vicinity of Dale's westward. Specimens were obtained at: Red Bluff, 300 feet; Coyote Creek, 270 feet (December); Dale's, 600 feet; Grasshopper Valley, 5300 feet; Petes Valley, 4500 feet. Observed also at the following additional localities: six miles north of Red Bluff, 500 feet; Sisson's, 270 feet; Cone's, 270 feet, December; Bloody Island, 350 feet; Mill Creek, 260 feet; Payne Creek, 1600 feet; Manton, 2300 feet; Battle Creek Meadows, 4800 feet (once, June 23, 1925); Termo, 5300 feet; four miles northeast of Red Rock P. O., 5500 feet.

A male collected in December at Coyote Creek weighed 27.5 grams. Two females of same data weighed 28.4 and 32.6 grams. A male and female, both adults, from Red Bluff in early May weighed 31.3 and 30.2 grams, respectively. A young female, full-fledged, taken at Dale's, May 24, weighed 28.2 grams. An adult male from Petes Valley, July 12, weighed 29.7 grams. One from the south end of Grasshopper Valley, June 18, weighed 29.1 grams.

This species, which habitually forages on the ground, makes use of more elevated sites for singing perches, for resting, and for safety, probably because the chances for seeing approaching dangers are better on an elevated perch than on the ground. As examples, the following list of situations in which lark sparrows were definitely observed is given: in sycamore, in blue oak, in live oak, in low branches of valley oak, on rocky mesa with scanty grass and a few scattering blue oaks (fig. 55), on dry hills and along road, on fence at side of road, in thicket of weeds along a fence, in alfalfa field, in ceanothus bushes, well up in yellow pine at edge of meadow, on bare ground at edge of field, on rocks of cañon wall, in sage-bush, in juniper.

The characteristic most prominent in the above list is that of openness; that is, in each case, there is freedom from obstruction that might hinder a clear view of, and quick flight from, some approaching danger. It is also apparent that this sparrow is able to get along in those drier portions of the section where water is not continually available.

Sometimes, in winter, this species assembles in flocks. At Coyote Creek on December 28, 1927, a flock of more than fifty individuals was observed feeding on a strip of bare ground at the edge of a field. When disturbed, the birds flew to a near-by wire fence, the flock keeping its compact formation. Most of the individuals kept calling continually. A much larger flock than that one, was seen at Cone's on December 29. These birds also were feeding on bare ground in a field. When disturbed they flew to large valley oaks where they called and even sang (Linsdale, MS).

During the first half of April most of the groups had broken up; sequestered pairs were most often seen. Singing individuals were then conspicuous.

One bird that was watched on April 15, 1928, was thought to be going through the stage of selecting a nest site. The sequence of the observations and interpretations of the movements of this bird were as follows: When first noticed the bird was on an open, north-facing slope walking over the ground and picking at objects, presumably for food. Then it flew quickly to the base of a small, shrubby blue oak and turned and fluttered in a small depression in the ground there; meanwhile it kept up an excited chirping. Several times the bird hopped out of the depression to the low twigs of the shrub or it moved in a circle over the ground, to return and flutter in the depression. Once, it started out and picked up a piece of dead plant which it hurriedly placed in the depression, and then flew away.

A few seconds later the same bird flew to the base of another shrub and fluttered on the ground there for a few seconds; then it moved out, picked up a stem of plant and quickly flew to a third shrub and placed the stem in a depression there. Fifteen minutes later the bird came to the first bush and repeated the moves of its first visit there, carrying in materials. The first depression had only a few pieces of carried-in material, scarcely enough to be distinguishable. In the third depression there were more pieces, but not sufficient to make more than the bare tracings of a nest. Only one individual lark sparrow was seen during all these performances. Once, it foraged close to a chipping sparrow but showed no concern over the proximity of this bird, of another species.

When that place was visited again on April 23, a search of the vicinity disclosed no nest; nor was any lark sparrow seen in that particular "territory." However, several were seen in that general vicinity. For some reason none of the three sites had been utilized for a nest up to that time (Linsdale, MS).

If the behavior recounted above is typical for this species at this stage of the nesting cycle, and it seems likely to us that it is so, then it appears that there is a time in the early part, at least, of nest building when the instinctive activity is not well directed and when a large share of the moves that should contribute to the structure of the nest are actually wasted effort. Of course, it is possible that all these apparently useless moves serve as practice or trials, with the result that the nest which is finally completed will be the less faulty, as to site or construction, or both.

A nest was found near Dale's that was being built on May 31, 1924. Grasses were being carried to the nest, in a live oak tree, both in the morning and evening.

A young lark sparrow just out of its nest was seen July 13, 1928, in Petes Valley. Later in July several family groups, of parents and young, were seen in the eastern part of the section.

Amphispiza belli nevadensis (Ridgway)

Nevada Sage Sparrow

Found by us in the section in summer from the vicinity of Eagle Lake, eastward. Specimens represent the following localities: Petes Valley, 4500 feet; two miles south of Ravendale, 5300 feet; Red Rock P. O., 5300 feet; Jones', 5400 feet. Observed also at the north end of Eagle Lake, 5200 feet, September 28, 1924.

An adult male, July 20, weighed 18.1 grams. Weights of four young males, full grown, collected in July were: 15.9, 16.5, 16.6, and 16.6 grams. Two young females weighed 14.2 and 16.8 grams.

The sage sparrow, like the Brewer sparrow, in the Lassen section, makes its home in the almost pure stands of sage-brush. Although seen often on the tips of the taller sage-bushes, individuals of this bird seemed even more at home on the ground between those bushes. Especially the adults, when approached or pursued, would, hurriedly, jump to the ground from a perch and escape from the view of the observer, effectively screened by the intervening bushes. This appeared to be a much better means of retreat than a flight course could be in such a situation.

The young were out of the nest and were in family groups in the eastern part of the section in mid-July, 1928. It was thought that the parent birds accompanied most of these groups, but the old birds were so shy that they kept at too great a distance from the observer to be readily detected.

The nine specimens collected within the section prove to be extreme of the subspecies *nevadensis*. They show no tendencies in the direction of either *belli* or *canescens*.

Amphispiza bilineata deserticola Ridgway

Desert Black-throated Sparrow

Specimens were obtained at Petes Valley, 4500 feet, in July, 1928, and a family group was observed just within the northeast corner of the section, northeast of Red Rock P. O., also in July.

Weights of three adult males were 13.5, 13.7, 13.7 grams; of three fully fledged young males, 12.7, 13.5, 13.6; of one fully fledged young female, 14.5 grams.

At the locations of observation in the section, the present species seemed to live in the driest, and apparently the hottest, areas in each neighborhood. They were in rock-covered, exposed, and sparsely vegetated situations. The birds were seen on the ground as often as in bushes.

While found in sage-bushes, as was the sage sparrow, the black-throated sparrow appeared to be less closely restricted to that plant. Other kinds of bushes and even small annual plants were used.

Several family groups of adults and young were seen in 1928, between July 11 and 25. No more than two families were seen in any one day.

Black-throated sparrows were observed June 8, 1929, on a flat desert plain at the side of Petes Valley. Rocks, some of them several meters in diameter, covered the ground so that very little soil showed. The more conspicuous of the scattered plants were small bushes of antelope-brush, a kind of *Salvia*, sage-brush, and rabbit-brush. A singing male was watched for a long time. When approached the bird would trot off over the ground to a new bush tip where it would continue to sing until routed out again. Any perch within *acres* seemed to be satisfactory.

Junco hyemalis hyemalis (Linnaeus)

Eastern Slate-colored Junco

A sparse midwinter visitant to the section, as indicated by two specimens captured: a male (no. 51866), ten miles north of Red Bluff, 500 feet, January 2, 1928, and a female (no. 51865), Cone's, 270 feet, December 29, 1927. The male weighed 20.9 grams; the female, 17.3. The first designated bird was on open ground in company with other juncos (of the Oregon type), near a clump of willow and other trees.

Junco oreganus oreganus (J. K. Townsend)

Northwestern Oregon Junco

Four of the juncos collected in winter in the western part of the section were found to belong to this race. Localities and dates represented by the specimens are: Tehama, 250 feet, December 28, 1927; Dale's, 600 feet, December 21 and 22, 1924; Elliott's, 1000 feet, December 25, 1927. A male and a female, both taken in December, weighed 17.4 and 17.2 grams, respectively. In one of these cases, of the one shot on December 22, the bird was alone in a live oak. In the other cases the birds were members of flocks or scattered companies believed to consist chiefly of *J. o. thurberi*; at least, other birds shot at the same time were of this race.

Junco oreganus shufeldti Coale

Shufeldt Oregon Junco

Four skins among our winter-collected juncos from the western part of the section are referred to this race. These specimens were obtained at: Payne Creek P. O., 1600 feet, December 22, 1927; eight miles east of Payne Creek P. O., 2850 feet, December 24, 1927 (two); eleven miles east of Payne Creek P. O., 3500 feet, December 24, 1927. Of these, a male and a female weighed 20.8 and 17.6 grams, respectively.

Junco oreganus thurberi Anthony

Sierra Nevada Oregon Junco

Present in summer in the coniferous forests of the section commonly from the 3000-foot contour line on the west, east to the vicinity of Eagle Lake; in winter found by us widely spread in the western part of the section from 3500 feet down to the lowest altitudes. Localities where specimens were collected are as follows: ten miles north of Red Bluff, 500 feet, January; six miles north of Red Bluff, 350 feet, January; Coyote Creek, 270 feet, December; Cone's, 270 feet, December; Tehama, 250 feet, December; Dale's, 600 feet, December; Elliott's, 1000 feet, December; Payne Creek P. O., 1600 feet, December (observed also on April 22, 1928); eleven miles east of Payne Creek P. O., 1600 feet, December; Antelope Creek at 3000 feet, June; near Mineral at 6000 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Gallatin's, 5200 feet (June 1, 1925); five miles north of Fredonyer Peak, 5700 feet (October 1, 1924).

Observed but not collected at the following additional places: Silva's, 270 feet, April 12 and 13, 1928; Manton, 2300 feet, April 18 to 20, 1928; four miles southeast of Manton, 3000 feet, April 21, 1928; Lyman's, 3300 feet; Turner's, 3500 feet; Turner Mountain at 6300 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet (many dates in summer, and December 21, 1927, two seen, subspecies doubtful); Broke-off Mountain, up to 8000 feet; Summit Creek, 5200 feet; timber line on south slope Lassen Peak, 9500 feet, August 1, 1925; Lassen Peak at summit, 10,437 feet (July 13, 1924, and August 1, 1925); Warner Creek at 6600 feet, September 24 to 26, 1923; Willow Lake, 5600 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Spalding's, 5200 feet (October 14, 1923); Eagle Lake Resort, 5200 feet (May and June).

Weights of thirty males in December ranged from 15.1 to 22.5 (average 18.9) grams. Seven females, December, ranged in weight from 17.1 to 19.3 (average 18.5) grams. A May-collected male from near Mineral weighed 18 grams. Four June and July taken males weighed 17, 18, 19, and 19.3 grams. A female, full-fledged juvenile, July 13, weighed 12.8 grams. An immature female in October weighed 17 grams.

The junco in its summer habitat within the coniferous forest area was limited fairly closely to the near vicinity of moist places. Mountain meadows formed the more extensive of these favored situations.

Stream-sides, lake-shores, and even the borders of receding snow banks each provided conditions attractive to juncos. Trees frequently associated with this bird were lodgepole pine, red fir, and hemlock.

In detail, some of the places where juncos were observed in summer are as follows: five meters up in pine near creek; along edges of meadows and willow bogs where bordered by lodgepole pines; in tract of lodgepole pine; in an area of willow thickets, tall grass, blossoming herbs, and luxurious veratrum, with scattered, fallen lodgepole pines and snags and some standing trees of that species; flying, singing, or foraging around or on melting snow banks; at melting margins of a snow bank in the shade of a dense fir clump; in timber along a stream; lower foliage of a hemlock; singing at tip of lofty red fir; at the shore of Eagle Lake; at edge of snow in deep fissure of Lassen crater, and around rock heap in crater.

In the fall and winter, flocks and small companies of this junco were found feeding in places characterized in our field notes as follows: at a spring; in dead, water-killed timber at Eagle Lake; at scattered hay in fields or on roads; on dry ground beneath yellow pine; beneath brush on recently burned slope; on bare ground in a garden; on open ground near trees and in grass bordering irrigation ditches; on grassy ground, hurriedly foraging in partial shelter beneath buckeye trees, snow falling all about; on river gravel under cottonwoods; in weedy fields at Cone's, flying when disturbed to strips of trees at borders; on snow-covered flats, gleaning seeds from grass which stuck up through the snow; scratching and digging beneath thick live oaks on patches of nearly bare ground, surrounded by snow; in old vegetable garden, where tall weeds stuck up through the snow, well scattered out, working over seed heads; in potato field at Dale's feeding on heads of pigweed (*Amaranthus retroflexus*) sticking above the snow; clinging, six meters above the ground, to bark of a nearly vertical limb of a digger pine.

In April, flocks of juncos were still seen at low altitudes, singing and feeding in the foliage of blue oaks and valley oaks that were just leafing out.

On April 19, 1929, in the vicinity of Mineral many small groups of juncos were foraging on bare or nearly bare ground wherever there was an opening in the timber and also around the edges of meadows.

The instances cited above demonstrate that at seasons other than the nesting period birds of this species exercise a capacity to forage over a wider range of conditions than when they are on the breeding ground. Thus, the birds in the non-breeding seasons may forage in such unusual places as on the trunks of trees and in high strata of arboreal foliage.

When disturbed while feeding on the ground flocks of juncos nearly always flew to the foliage of trees to escape. However, if not pursued, the birds would quickly return to the ground and resume their foraging.

Near Payne Creek P. O., December 23, 1927, in the mid-morning, large numbers of juncos were encountered bathing in a shallow seepage pool on the mesa. The day was gloomy and cold from the human standpoint.

On July 3, 1924, one junco was heard giving a "whisper song" which the observer considered would be a "very laudable performance, if louder" (Hunt, MS).

On Battle Creek Meadows on May 17, a female was watched gathering nest material. The bird picked up fine, dry grass stems, until it had a regular sheaf of them crosswise in the bill, seemingly to the limit of its capacity to hold them. After much hesitation, perching on a fence post and lower rails, with the male in close attendance, the female flew to the ground and to a partly formed nest out in the meadow, which was brilliantly grown to blossoming yellow buttercups of an early blooming species. The nest was beneath the broken and projecting end of a short, old, weathered section of a tree stem about 20 centimeters in diameter.

This nest contained one egg on the evening of May 25 and four eggs on the evening of May 28.

The earliest nest containing the full set of four fresh eggs was seen in Battle Creek Meadows on May 21, 1927. The site was in a tract of small lodgepole pines growing rather scatteringly, and it was sheltered from above by a slanting snag about 12.5 centimeters in diameter. The nest rim projected one centimeter above the surrounding ground. In the same vicinity another nest with four eggs was found, May 27, 1927. It was on the ground under a slanting branch of a leafless shrub.

Young, bob-tailed juncos were seen out of nests, commonly, in the vicinity of Mineral as early as June 6, 1928, and June 12, 1925.

Near Eagle Lake Resort on June 11, 1929, when an observer stepped within two meters of it, a brooding junco flushed from a nest containing four eggs. The location was halfway up a rather steep northwest-facing slope 250 meters from the edge of the lake. The rim was flush with the ground surface. The slope was covered with pine needles. Trees standing two and four meters distant were white firs. Yellow pines also stood on the slope. The nest was at the base of a yellow pine seedling one-third of a meter high. Dead sticks and trash projected over and 10 centimeters above the nest. The site was in a place that would be shaded for most of the day. Both birds of the pair came near but they were silent.

A nest was found, June 13, 1925, twenty meters from the edge of a stream and willow thicket on Battle Creek Meadows. The site was at the northeast base of a small cedar, less than a meter in height, in a grassy place beneath scattering lodgepole pines. Dandelions and buttercups were growing all about. The nest in place measured 55 millimeters across. Its rim was one centimeter above the general level of the sod surface. The hollowed-out cavity was 90 millimeters across by 55 deep. The walls of the nest were thus rather thin though they were compactly woven. There were four fresh but cold eggs in the nest. Adult birds that were solicitously attending nearly grown young flying about the vicinity were thought possibly to be the owners of this nest.

On the same meadow, June 22, 1928, a female was flushed from a nest beneath a small cedar, growing on a bank within 51 centimeters of the edge of a little meadow stream. The nest was sunk in the ground at the base of the stem and on the side toward the stream. Its rim was even with the ground surface. Five fresh eggs were taken from this nest. Independently foraging young juncos were common all about the vicinity at this time.

The latest nest with eggs was found on July 8, 1925, also on Battle Creek Meadows. Incubation in the five eggs was then far advanced. The site was in partial shade of small lodgepole pines in a tract of the same. The nest was resting on the ground, not in a hollow. It was sheltered from above by an "awning" formed by the broken-off end of a log 20 centimeters in diameter and overgrown by tall grass and herbage. The nest rim extended 45 millimeters above the ground. The brooding bird did not flush until a person stepped within 25 centimeters of the nest.

It is perhaps noteworthy that the only two instances of five eggs or young in a nest were of dates toward the end of the breeding season. Usual experience with passerine birds indicates that the sets of largest number are laid, as a rule, at the outset of the nesting season, later sets being smaller. Whether the above designated large sets of junco's eggs were laid as second sets by one female the same season is, of course, not definitely known.

This ground-nesting bird appears normally to rear two broods each season in the Lassen section; and the number of eggs per set, four or five, is high. This high rate of reproduction indicates that at some early period in the individual life-history there is a high percentage of mortality. This feature is probably correlated with the limitation ordinarily of so many of the birds' activities to the ground where the largest number of destructive agencies is likely to be operative.

Spizella passerina stridula Grinnell

Pacific Chipping Sparrow

Summer resident, widely and numerously distributed in our section as far east as Eagle Lake. Specimens collected as follows: Red Bluff, 350 feet, May 8, 1924; Dale's, 600 feet, May 19, 1924; Battle Creek Meadows, 4800 feet; two miles west of Black Butte, 6800 feet. Occurrence established by observation at the following additional localities: Bloody Island, 350 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Mineral, 4900 feet, May 7, 1927; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; Lake Helen, 8200 feet; Wilson Lake, 5100 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Bogard R. S., 5500 feet; Eagle Lake Resort, 5200 feet, May 14, 1925; Spalding's, 5200 feet, October 14, 1923; six miles north of Red Bluff, 400 feet, April 5, 1928; Turner's, 3500 feet, April 26, 1928; eight miles southwest of Ravendale, 5600 feet, July 18, 1928.

The five adult males collected in summer in the section averaged 12.8 (12 to 13.6) grams in weight. The two heaviest individuals were collected in the early part of the season and they were both from the lower portion of the section.

In the vicinity of the Sacramento River individual chipping sparrows were observed in and under the scattered valley oaks. At Manton, in the foothills, singing birds were seen in orchard trees, in digger pines, and among scattered clumps of tall chaparral. In the higher mountains these birds were often heard singing, up to 25 meters above the ground, in white firs, yellow pines, and hemlocks, and also in the clumps of smaller lodgepole pine and aspen at the margins of the forest. Two birds that were observed at Spalding's, October 14, 1923, were in the stub-forest at the edge of Eagle Lake.

Feeding birds were most often seen upon the ground, sometimes in groups there.

Evidence of nesting activity of this species was noted earliest near Mineral on May 15, 1927, when a chipping sparrow was seen gathering nest material. Near Wilson Lake, May 24, 1927, a bird was watched while at work building a nest 3.6 meters above the ground in a cluster of foliage of an outer, lower branch of lodgepole pine. A nest that was found near Mineral, June 3, 1927, contained three well-incubated eggs. This nest was resting on two "needly" horizontal twigs, 2.2 meters above the ground in a very small yellow pine.

Early in the morning of June 13, 1925, a chipping sparrow was watched as it moved in a spiral course down from the upper part of a middle-sized yellow pine to a limb nearly 5.4 meters above the ground and out about 1.8 meters to near the end of the limb. This bird went to a nest there which was concealed and sheltered by tufts of needles. When first discovered, this nest contained two fresh eggs. The brood of young birds left the nest on July 6, approximately twenty-one days after incubation was judged to have started. Two of these young were seen in small yellow pines on the morning of July 7. Each was bob-tailed and each had wisps of natal down still adhering to the contour feather-tips on its head. The parents of this brood appeared, on the latter date, to be starting another nest, as they were then gathering nest material. The male was singing now and then, and the birds copulated four times in one minute although they were greatly concerned immediately afterward over a too close approach of the observer to a young one (Grinnell, MS).

At Mineral, on June 16, 1925, a nest was discovered in one of a clump of three close-growing yellow pines in the open, apart from other trees. Some clumps of snow-brush grew nearby, but bare ground predominated in the vicinity. This nest was very shallow. It rested on needles and two small twigs resting against the main stem (diameter 15 mm.), and was 1.63 meters above the ground. One of the branches forming the support came from an adjacent tree, but was held against the other so firmly as not to move in any ordinary breeze. A bird was sitting closely on four far-incubated eggs. A closely sitting female was found, June 18, on a nest containing three eggs and placed 1.1 meters up, in a blossoming branch of snow-brush. The site was in an open area among firs and yellow pines.

Another nest was found, July 7, 1925, in a spray of snow-brush near the edge of a clump of the same. This nest was only 78 centimeters above the ground and was well sheltered and shaded by dense leafage directly above. There were many young yellow pines close by; but, in this instance, the birds had chosen for the nest site the low bush. There were four half-feathered young in the nest.

Bob-tailed young out of the nest near Mineral were seen June 7, 1928. On June 9, in that locality, a nest with three small young was found one-half meter above the ground in a little cedar.

The latest date on which a nest containing eggs was seen was July 19, 1925, when one out of four eggs in a nest in a small yellow pine at Mineral remained unhatched. Later, this remaining egg hatched; but the young birds had all disappeared by July 25, when the nest was visited again.

The records given above indicate that for the vicinity of Mineral the modal number of eggs per set is four, but that the full number is sometimes only three. Also, in some cases, there are probably two broods in a season. In mid-May of 1927 this was considered the most abundant bird species in the neighborhood of Mineral (Grinnell, MS). Other observations show that chipping sparrows are present at most of the stations below the 5000-foot contour in nearly equal numbers, but that there is a marked decrease in numbers at stations above that level.

Spizella breweri Cassin

Brewer Sparrow

Present in summer in eastern part of the section, westward regularly at least as far as Bogard R. S.; observed near Manzanita Lake, June 6, 1926 (fig. 87). Specimens were saved from the following localities: Manzanita Lake, 6000 feet; north end of Eagle Lake, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; two miles south of Ravendale, 5300 feet; Red Rock P. O., 5300 feet. Observed also at the following additional localities: Bogard R. S., 5500 feet; Spalding's, 5200 feet; east side Willow Creek Valley, 5000 feet; Horse Lake, 5000 feet; Termo, 5300 feet; seven miles south of Ravendale, 5400 feet.

An adult male from Manzanita Lake, June 6, weighed 11.5 grams. One from Petes Valley, July 11, weighed 11.1 grams. An adult female from Red Rock P. O., July 23, weighed 10.3 grams. A young male, July 18, weighed 10.1 grams. Weights, in grams, of three fully fledged young females, July 8 to 14, were: 10.6, 11.2, and 14.0.

Almost always this species was found closely associated with sagebrush. Here individuals perched either in the tops of clumps of that plant or conveniently near; for example, in rabbit-brush, or on wires and posts of fences.

The record farthest west in the section was of several birds, thought to be nesting, seen June 6, 1926, on the chaparral-covered slope above (south of) Manzanita Lake. Here this sparrow was in a habitat very different in appearance from the usual one of this species. The chaparral consisted largely of green manzanita, and the commonest associated bird was the fox sparrow. There were numbers of the Brewer sparrows, some in full song, and one specimen was preserved (Linsdale, MS). Nowhere else in the section under such extraordinary conditions for this species was it found.

Four occupied nests of the Brewer sparrow were seen in Petes Valley on June 8 and 9, 1929. Three of these were in small clumps of sage-brush and the fourth was in a similarly shaped shrub of another species. Heights from the ground in centimeters were 17, 30, 32, and 50. One nest contained four eggs; the other three each held four young, ranging in age from small ones in down to one brood nearly fully feathered. Two of these nests were within 65 meters of one another. When the brooding birds were driven from the nests they usually flew off silently, sometimes returning to a near-by bush and protesting weakly at the intrusion.

On June 17, 1929, a nest was seen seven miles south of Ravendale. Its rim was 30 centimeters above the ground and it was situated in the center of a small clump of rabbit brush on rather open ground at the edge of a meadow. Inside diameter at the rim was 50 millimeters. The lining was chiefly of black horsehair. Three eggs made up the set in this nest. The brooding bird flew off when approached within one meter, and it quickly returned, hopping on the ground within two meters of the intruder and chirping nervously.

At three miles south of Ravendale a nest was seen, June 19, 1929, its rim 45 centimeters above the ground. This one was in the center of a clump of sage-brush. It was made of grass stems and leaves and was lined with rootlets. Inside diameter at the rim was 50 millimeters. An adult was brooding three eggs. When disturbed the bird ran off over the ground.

The song of this sparrow suggested to one observer the song of the closely related clay-colored sparrow. The birds were in full song near Red Rock P. O., June 19, 1928, where they were heard from time to time even during the night.

At the north end of Eagle Lake, on June 18, 1928, a Brewer sparrow's nest was found in a small dense rabbit-brush bush (*Chrysothamnus*) growing somewhat apart from other bushes. The nest rim was 37 centimeters above the ground. The female was sitting on four eggs. A male was seen close by and was heard singing.

A nest containing three eggs nearly ready to hatch was seen at Box Springs on July 8, 1925. This nest was in a sage-bush, a little under one meter above the ground.

Another nest in a sage-bush and one-half meter above the ground was seen at Petes Valley on July 11, 1928. This one contained three eggs, probably infertile, and one young bird which fluttered out of the nest when disturbed. On July 19, an adult was watched carrying large insects and feeding them to a young bird out of its nest and able to fly.

After the close of the nesting season, Brewer sparrows assembled into flocks composed of the members of one family or of two or three families combined. On the average, at that time of the year, twenty-five individuals would be seen in one morning's circuit in the eastern part of the section.

The one bird collected from those seen near Manzanita Lake, and the occurrence of which has been commented upon above as under quite unusual conditions for this species, is an adult male (no. 48531), and it shows features worthy of remark. In coloration, the ground of the dorsum is gray-toned rather than sandy buff, against which the black streaks on both top of head and back stand out boldly. The feet and bill are decidedly darker than in the great majority of *breweri*, though certain newly-taken examples of the latter from Esmeralda County, Nevada, have the bill and feet quite as dark. The wing and tail are short (59.4 and 60.1 millimeters, respectively), and the wing end is more rounded, not so pointed as in usual *breweri* (primaries 7, 8, and 9 are nearly equal in length in no. 48531, instead of 8 being the longest).

In making the above comparisons we were astonished to find that our Manzanita Lake bird approximated or even duplicated *Spizella taverneri* in most of its peculiarities of coloration (see Swarth and Brooks, 1925, p. 67). In dimensional features, however, it differs from both *taverneri* and the examples of *breweri* with which we compared it, by being smaller except for bill. Obviously, more specimens from the out-of-bounds "colony" of *breweri* (the name we here apply to it, though provisionally) at Manzanita Lake are highly desirable. But enough facts have come to light to suggest a "tendency" in birds from the extreme northwestern outposts in the general range of *breweri*, toward *taverneri*. Indeed, if the criterion of intergradation through individual variation be resorted to, the heretofore supposed gap between *breweri* and *taverneri* disappears, so that the two forms would best be treated as subspecies of one species.

Zonotrichia coronata (Pallas)

Golden-crowned Sparrow

A transient over most of the section and a winter visitant below 3000 feet altitude on the western slope of the section. Collected at the following stations: Red Bluff, 300 feet, May 4 and 12, 1924; Dale's, 600 feet, May 25 and December 20 to 25, 1924; Elliott's, 1000 feet, December 25, 1927; Payne Creek P. O., 1600 feet, December 22, 1927; Warner Creek at 6600 feet, September 21, 1923 (not saved); five miles north of Fredonyer Peak, 5700 feet, October 4 to 6, 1924. Also, observed but not collected, at the following places: Blue Tent Creek, 300 feet, January 2, 1928; Cone's, 270 feet, December 29, 1927, and April 24, 1928; Manton, 2300 feet, April 18 to 21, 1928; eight miles east of Payne Creek P. O., 2800 feet, December 31, 1924; Turner's, 3500 feet, April 26, 1928; Mineral, 4900 feet, May 10, 1927.

Seven December-taken males from Dale's weighed 33.6 (30.5 to 37.2) grams. Three October-taken males from the eastern part of the section weighed 29.1, 34, and 35 grams; a female of same data, 31.2. Three females, May 4, 12, and 25, from the western end of the section, weighed, respectively, 29.8, 30.1, 24.5 grams.

At Dale's on May 25, 1924, a golden-crowned sparrow was seen and then shot as it hopped through a clump of buck-brush seemingly in perfectly normal fashion. If the observer had not been a collector, with conviction that so extraordinary a date of occurrence ought to be backed up by a specimen, he probably would have made record of the occurrence as in no way fortuitous. But when the bird was shot it was found that one wing had been injured (broken) and had healed, so that flight was doubtless impossible. It was suspected that the bird had flown against a barbed wire of a fence, such as is so plentifully strung in the vicinity. This occurrence, then, was without significance as regards migratory movements. The latest other date of occurrence in spring was May 12, 1924, when a single bird was seen and obtained from the bank of the Sacramento River near Red Bluff. The spring migration through the section was practically over by the end of the first week of May, so that all the individuals seen after that were probably stragglers.

In 1927, at Mineral, two late transients were seen on May 10.

First arrivals of this species in the fall were noted at 6600 feet on Warner Creek on September 21, 1923, and at five miles north of Fredonyer Peak on October 5, 1924. On both these occasions the first birds noted were caught in traps that had been set to catch small mammals. This possibly indicates that the birds were especially hungry when they arrived and that they immediately began to forage widely.

Favorite foraging places for this species in the western part of the section were thickets of weeds, willows, and blackberry. Small flocks could be seen scratching openly among leaves, provided they had access to cover in some sort of thicket conveniently near. Ordinarily, individuals of this species chose perches within one meter above the ground. Scratching seemed to be a less strongly marked habit with this than with some of the other ground-feeding sparrows: in the case of this sparrow a large share of the food was observed to be picked up directly from the ground surface.

In December, 1924, in the vicinity of Dale's, golden-crowned sparrows were noted as extraordinarily numerous. After a heavy snowfall most of these sparrows in the vicinity congregated in potato fields where many pigweeds (*Amaranthus retroflexus*) with dense seed heads stood up through the snow. The birds worked on these incessantly, tearing them to pieces either by clinging to the stems or reaching up to the shorter ones, and then searching with bill and feet the snow surface beneath. The snow was peppered with débris under each weed stalk. Where a seed head was partly buried in the snow a bird would "burrow in" after it. The birds were so busy getting food that they seemed far tamer than usual.

Also in the vicinity of Dale's some individuals were observed scratching on the snow-free areas beneath live oaks and even under clumps of buck-brush. Another place where this bird obtained food was where hay had been scattered over the snow for the range cattle temporarily deprived of natural forage. One bird was observed feeding apparently in a not-normal situation. This one was nearly two meters up the trunk of a big digger pine, clinging sideways to the rough bark, flitting from one claw-hold to another, inspecting crannies, and twice getting something which it ate.

One individual was found, December 23, in the top of a valley oak.

In April, in addition to feeding on the ground and in bushes at the margins of woods, several groups of golden-crowned sparrows were feeding in the tops of trees, especially the blue oak. It was thought that they were eating insects there. When frightened, the birds would fly down to bushes close to the ground for safety, much as they do when feeding on open ground.

One of the specimens taken (no. 51864, sex not determined, but probably male), at Elliott's, December 25, 1927, was partly albinotic and was picked out as such from a company of zonotrichias which frequented a blackberry tangle and near-by weed patches. This bird shows albinism mosaically here and there: middle claws, tibiae, left scapulars, mid-dorsum, head, and base of bill. On the head, the pigments that are left out on the feathers affected by albinism are those involving the gray, brown, and black colors, but *not the yellow.* The result of this condition is that our bird shows a broad patch of clear strontian yellow across the forehead from one upper eyelid to the other; this yellow runs forward medially to the base of the culmen and backward so as to cover over some feathers that are chiefly black. The occiput and hind neck show an irregular mixture of normally colored and white feathers; the whole side of the head from base of bill to part way through auriculars, including eye-ring, is pure white.

The patch of yellow showing so conspicuously and extensively on this bird may be interpreted as normal in this latter regard, for certain age plumages; but usually said yellow is concealed and restricted through the dominance of the normal dark pigments. An alternative explanation would be by some (to us unknown) process of color substitution.

Zonotrichia leucophrys leucophrys (J. R. Forster)

Hudsonian White-crowned Sparrow

A summer visitant, sparsely, to the higher, mountainous portions of the section. Specimens were saved from the following places: west base of Lassen Peak, 7000 feet; Warner Creek at 8000 feet; east base of Lassen Peak at 7600 feet. Observed also at: Mineral, 4900 feet; south slope of Lassen Peak at 8000 feet; Warner Creek at 6600 feet; Bogard R. S., 5500 feet.

Weights, in grams, of a male and female in mid-June were 29 and 28.9, respectively. Two females, one adult and one young-of-the-year, taken at 8000 feet on Warner Creek, September 10, weighed 26 and 30 grams, respectively. An adult male, same place, September 16, 24 grams; male young-of-the-year, same place, September 15, 27.1.

Nearly every Hudsonian white-crowned sparrow observed in the section was in or among thickets of willows, usually near the sources of, or at the edges of, mountain streams. One that had been disturbed perched in the tip of a small hemlock and gave its alarm note.

Birds of this race thought to be still on their breeding ground were collected as late as September 16, 1923, at 8000 feet on Warner Creek. One was seen April 19, 1929, feeding on the ground at the lower end of Battle Creek Meadows.

On May 17, 1924, in a cañon at 8000 feet on Lassen Peak the thickets of willow were still snow-bowed-down and leafless. Even so, white-crowned sparrows in full song were heard there on that day. At this same location, on August 1, 1925, the species was observed again, and at least one young bird was seen. This time, no songs were heard, only the metallic alarm notes.

On June 11, 1926, at the head of Manzanita Creek, at the west base of Lassen Peak, a pair was collected, the female of which contained eggs nearly ready for laying.

On the meadow at Bogard R. S. a colony of white-crowned sparrows was studied on June 21 and 22, 1929. There the birds were inhabiting the scattered clumps of willow to which they were limited rather closely. One individual was seen out in the sage-brush. About half the twenty-five or more pairs of adults behaved as though they had young. They were observed holding insect food in their bills and calling nervously in the vicinity of particular clumps of bushes.

Several nests were found at Bogard R. S. One nest, one-half meter above the ground on leaning dead twigs and stems of a small willow clump, contained four eggs. Both adults came near and showed concern. On the next day an empty nest was seen in a similar position to the first one found. On a nearby stem of willow was perched a bob-tailed young bird.

Another nest which contained four eggs was supported on leaning dead stems of a willow clump. The rim was 45 centimeters above the ground. Inside diameter at the rim was 60 millimeters, depth in center, 47 millimeters. The rim was broad and flat. The main structure was of sticks and coarse grass stems; the lining of fine grass stems. The brooding adult permitted approach to within one meter. Twelve meters from this one was another nest, also containing four eggs. This was near the center of and well settled upon the base of a willow clump. Its rim was 40 centimeters up. The walls were thinner than those of the previous one found. More coarse material had been used in its construction. Adults of both these pairs showed much concern over the presence of the observer. A third nest in this group twenty meters farther on from the last was similar to it in appearance and position. This one held three downy young. The parents, in the next willow clump, were very nervous.

At Mineral, the lowest and westernmost point of observation for this subspecies, one and only one pair was to be seen regularly each of several summers in certain thickets of willow and aspen along Martin Creek where this stream made out onto Battle Creek Meadows.

Our records for the Lassen section, taken all together, indicate the Hudsonian white-crown to be relatively uncommon there, as compared with its status on the main Sierra Nevada to the southward. Willowy seepage ground is less in extent in the Lassen region.

Zonotrichia leucophrys gambelii (Nuttall)

Gambel White-crowned Sparrow

Occurs as a transient, probably over most of the section; also winters in the lower, western end of the section. Specimens represent the following localities: Coyote Creek, 270 feet, May 14, 1924; Cone's, 270 feet, December 29, 1927; Dale's, 600 feet, December 25, 1924; Warner Creek at 6600 feet, September 20, 1923; Slate Creek, 5700 feet, September 27, 1924. Observed also at the following places: Blue Tent Creek, 300 feet, January 1, 1928; Red Bluff, 300 feet, May 5, 1924; Sisson's, 270 feet, April 20, 1911; Manton, 2300 feet, April 20, 1928; Turner's, 3500 feet, April 26, 1928.

Two December-collected males from Cone's weighed 23.8 and 25 grams. One from Dale's in December weighed 31.2 grams. Two males from the eastern part of the section in late September weighed 25 and 26.8 grams. A male from Coyote Creek, south of Red Bluff, May 14, 1924, weighed 23.9 grams.

The situations in which this species was found in the section were characterized, by observers, as follows: in willow at edge of the river; on ground beneath valley oaks overgrown with wild grapevines; on road where hay had been scattered; in weed patches and stream-side thickets; in fields of dense dead *Centaurea;* in pasture; in brush and drift along slough; on ground and in lower portions of trees at edge of woods; on ground among and in clumps of buck-brush; in brush piles, shrubs, and blue oaks; in manzanita and snow-brush.

A comparison of the above types of habitat frequented by this transient and winter visitant race with the types of habitat chosen by its close relative which is present only in summer shows that, although the former race is present in greater numbers, it (*gambelii*) exercises a much wider range in choice of habitat than does *leucophrys* within this section. While this difference may possibly be due partly to the greater number of *gambelii* present, it is most likely due in major part to the fact that the two races are present in different seasons. That is, in this species individuals are likely to occur through a much wider range of conditions in winter than in summer. This less rigid restriction to narrow habitat limits in winter is correlated, possibly, with the flocking tendencies which are distinguishable at that season. Both these features seem to be adaptive responses in solving the problem of food-getting at the winter season.

The Gambel white-crowns we found wintering in the Lassen section appear to mark the northernmost station for this subspecies at that season. Our impression is that their aggregate numbers are much smaller there than occur in winter in southern California, the latter marking, therefore, more nearly the metropolis of the winter territory as regards the Pacific coast region.

At 6600 feet on Warner Creek this sparrow was captured as early as September 20, 1923, two days before the first snow of the season. At that place, after the snowfall, the birds were feeding out on snow-covered flats and on the ground beneath bushes overlaid with snow. This subspecies was quite surely here a transient only.

Zonotrichia leucophrys pugetensis Grinnell

Puget Sound White-crowned Sparrow

A white-crowned sparrow collected (no. 51862) at Cone's, 270 feet, December 29, 1927, belonged to this race. It was a bird-of-the-year and weighed 22.6 grams. This individual was in company of Gambel white-crowns in weedy thickets bordering a stream (Linsdale, MS).

Passerella lincolnii lincolnii (Audubon)

Northeastern Lincoln Sparrow

Found by us as a transient in the western end of the section and, in the mountains from 4800 feet up to 8200 feet, as a regular summer visitant.

Specimens were saved from the following places: ten miles north of Red Bluff, 500 feet, April 10, 1928; Red Bluff, 300 feet, May 12, 1924; Cone's, 270 feet, April 24, 1928; Battle Creek Meadows, 4800 feet, June 24, 1924, and July 2, 1925; small lake near Manzanita Lake, 6000 feet, June 12, 1926; one mile west of Black Butte, 7400 feet, July 3, 1924; Lake Helen, 8200 feet, July 13, 1924; Warner Creek at 8000 feet, September 10, 14 and 15, 1923; Warner Creek at 6600 feet, September 20, 1923; Bogard R. S., 5500 feet, June 21, 1929. Observed also at Coyote Creek, 270 feet, April 17, 1929; Silva's, 270 feet, April 12 and 13, 1928; Antelope Creek at 300 feet, April 11, 1928.

A male and two females, collected in April and May near the Sacramento River, weighed 17.8, 17.4, and 18.9 grams, respectively. Immature, September-collected birds, two males and one female, from Warner Creek, weighed 16.7, 17.4, and 13.5 grams, respectively. Weights of three adult males collected between mid-June and early July were: 18.3, 18.3, and 19.8 grams. An adult female collected June 12 weighed 18.5 grams. A fully fledged juvenal female from Lake Helen, July 13, weighed 12.4 grams.

During the period of the spring migration, in April and early May, when this species occurred in the lower western part of the section, scattered individuals were seen in thickets of dead brush close to the ground, in brushy borders of sloughs, in the edges of fields bordering streams, and in piles of driftwood in stream courses. In summer when the birds were on their nesting grounds in the higher parts of the mountains, they were observed only in or near thickets of alder or willow, in wet meadows, along streams, or at the edges of lakes. In one place on Battle Creek Meadows this sparrow was in a place characterized as follows: willow thickets, tall grass, blossoming herbs, and luxurious veratrum, with here and there fallen lodgepole pines, snags, and some standing trees of the same species. Other birds associated with this one here were: song sparrow, Traill flycatcher, pileolated warbler, yellow warbler, and russet-backed thrush. Within this habitat the birds of the present species foraged and spent nearly all their time on the ground or at least out of human sight beneath the screen of rank vegetation.

At Coyote Creek, on April 17, 1929, an individual on a mat of dead bulrushes at the edge of a pool was preening and fluffing out its feathers, after bathing.

At Mineral in 1927, the Lincoln sparrow was heard in full song in its summer habitat as early as May 8. However, at that time the willow thickets in which the birds were found were, as yet, leafless. On May 17, 1924, a sparrow was heard singing, at 8000 feet, beyond Soupan Springs toward Lassen Peak. The only cover available for it that could be seen then along the streamlets was some heather and clumps of very small hemlocks.

On June 20, 1925, much searching in a part of Battle Creek Meadows where a pair of adults showed marked concern resulted in flushing a bob-tailed young one from the grass. The bird fell into some water and rapidly flopped across it into a willow thicket beyond, where it successfully eluded further search.

A nest of the Lincoln Sparrow was found, June 21, 1929, at Bogard R. S. It was placed on the ground among grasses at the upper end of a meadow. The site was one meter from the trunk of a fallen, dead lodgepole pine and was almost directly beneath one of the limbs of the dead tree. Grasses and herbaceous plants near by were up to 30 centimeters in height. The nest was near some willow clumps and where it would be shaded for most of the day by some tall lodgepole pines. The nest was built of grasses and lined with fine stems. Its rim was flush with the level of the ground. The inside diameter at the rim was 60 millimeters. Inside depth was 55 millimeters. Four nearly fully feathered young were in the nest. All remained quiet until one was touched, when all of them started to leave. For over half an hour before the nest was found the two parents chirped excitedly in the dead branches of a nearby pine. One of them carried food and made many sallies toward the nest but did not actually go there.

A Lincoln sparrow was heard in song at Battle Creek Meadows as late as July 31, 1924.

The total number of birds of this species in the section must have been small, for more than one or two pairs were scarcely ever encountered in one day's observation. Of course, only an insignificantly small portion of the whole area of the mountainous part of the section would suit even the more gross habitat requirements of this bird.

It seems worthy of remark here that not one of the twelve specimens of *Passerella lincolnii* obtained in our section, transients as well as breeding birds, shows any approach to the race *P. l. gracilis.* The latter occurs quite as far eastwardly, to the southward in California, in fall, winter, and spring.

Passerella melodia mailliardi (Grinnell)

Modesto Song Sparrow

This was definitely the subspecies of song sparrow resident and breeding in the Sacramento Valley and up along the eastern tributaries to it at least as far as Battle Creek Meadows, 4800 feet (fig. 105). Song sparrows occurring at scattered places from there east to Kelly's, on Warner Creek, we place also under *mailliardi,* but not certainly, inasmuch as the specimens obtained from those places are not in plumage condition to warrant definite determination. Specimens were obtained at the following places: Cone's, 270 feet, December; Dale's, 600 feet, May and December; Elliott's, 1000 feet, June and December; Lyman's, 3300 feet, June; Battle Creek Meadows, 4800 feet, June and July; Willow Lake, 5600 feet, July; Kelly's, 5200 feet, July. Birds that quite surely belonged to this race were noted along the Sacramento River between Red Bluff and Tehama, May 14, 1924, and at Bloody Island, 350 feet, May 26 and 28, 1926.

Weights of three December-taken males from the western end of the section are 21, 21.4, and 23.9 grams; of four females, 20, 20.2, 22.5, and 23.3. Two adult May-taken males from Dale's: 21.7, 21.8; two adult males and two adult females from Elliott's, June: 19.5, 21.9, 20.1, and 21 grams, respectively.

Song sparrows in the western part of the section, in summer, stayed close to the streams and ponds where willows formed thickets at the edge of the water. The frequent capture of these birds in mousetraps set on the ground within their habitat helped to show that foraging is done extensively on the ground itself.

On April 19, 1929, in the vicinity of Mineral (fig. 22) at least two song sparrows were established and singing in clumps of willows. One was near Martin Creek and the other at the lower end of Battle Creek Meadows.

At Elliott's, April 14, 1928, many song sparrows were seen in the cat-tails and bulrushes about the pond there. Near the edge of the pond a nest was found fastened in a clump of *Typha* and *Scirpus* two-thirds of a meter above the water. The nest held three eggs. No bird was seen on the nest, but one chirped near by.

A nest found June 19, 1927, on Battle Creek Meadows, contained three young which hurriedly left the nest as it was disturbed. The site was in an upright fork of a large-sized, old willow stem in a clump of that plant over-growing the water of a meadow stream. The nest rim was exactly one meter above the water.

Fig. 145. Nest and five eggs of Modoc song sparrow (*Passerella melodia fisherella*) in a wild rose bush. Photograph taken June 23, 1921, at Eagle Lake. Mus. Vert. Zool. no. 3682.

Passerella melodia fisherella (Oberholser)

Modoc Song Sparrow

This race of song sparrow was found by us in the summer and fall in the vicinity of Eagle Lake and thence on suitable ground eastward (fig. 105). In winter, specimens were taken in the lower, western part of the section. Specimens represent the following localities: Dale's, 600 feet, December 22 to 25, 1924; Elliott's, 1000 feet, December 25, 1927; Eagle Lake Resort, 5200 feet, May; Spalding's, 5200 feet, October 13 and 17, 1923; north end of Eagle Lake, 5200 feet, June;. five miles north of Fredonyer Peak, 5700 feet, October 1, 5 and 6, 1924: Petes Valley, 4500 feet, July; Jones', 5400 feet, July. Additionally, seen:

at Bogard R. S., 5500 feet, June; along a stream at 5300 feet, eight miles southwest of Ravendale; Secret Valley, 4500 feet.

Weights are as follows: of six males taken within the west end of the section in December, average 22.9 grams (20 to 25.5); of one female, 20.8. Weights of seven females taken toward the east end of the section in October average 21 (19.5 to 23.1); of two males, 20.5 and 21.2. One female from Eagle Lake, May, 20 grams.

Fig. 146. Nest and four eggs of Modoc song sparrow (*Passerella melodia fisherella*) in broken mat of stems of bulrushes. Photograph taken June 23, 1921, at Eagle Lake. Mus. Vert. Zool. no. 3680.

The presence of water close by in combination with adequate cover seemed necessary for the existence of this sparrow in any locality.

On June 24, 1921, two song sparrows' nests were observed on the western shore of Eagle Lake. One nest, situated just off the ground in a rose bush, contained five eggs (fig. 145). The site of the other nest was beneath a clump of dead cat-tails and bulrushes (fig. 146). This nest held a completed set of four eggs.

In the upper portion of Petes Valley a nest was found on June 8, 1929. It was one meter above the ground in a gooseberry bush near the mouth of the cañon and twenty-five meters up the wall from the stream. The bush was surrounded by large boulders with a few bushes of rabbit-brush, sage-brush, antelope-brush, wild cherry, and gooseberry. The bush holding the nest was rather scraggly and one and one-half meters high. The nest was plainly visible for several meters in every direction. Contents were one unhatched egg and two downy young some days old. When the nest was approached one of the young opened its mouth for food while the other remained quiet. One parent came thirty meters away from the nest to meet the human intruder. It chirped excitedly, hopping from rock to rock and spreading the tail widely. Also the wings were spread and held slightly above the level of the back. The other parent was less excited. Twice an adult carried food to the young in the nest although a person stood within six meters and in open view. The alarm notes were much coarser and louder than the notes given when near the nest.

On June 16, 1929, a nest was seen in a weed clump at the edge of the stream in Secret Valley. The nest rim was 22 centimeters above the ground. The weed clump was one meter in diameter and a little over one meter in height. Surrounding vegetation was willow, rose, and sage-brush. The stream at this point was only one meter wide. Inside diameter of the nest at its rim was 60 millimeters. A bird was brooding three eggs when disturbed by a too close approach.

A nest containing four newly hatched young was found, June 18, 1928, at the north end of Eagle Lake. The nest rim was 49 centimeters above the ground. The site was the center of a rabbit-brush clump growing in a tract of that plant about 125 meters from the edge of the lake. At this place there were no plants at the water's edge; hence if these birds were to nest it would be necessary for them to go to the nearest bushes to find a satisfactory site; and these were of xerophilous kinds—with the result that here were found as nesting neighbors the ordinarily riparian song sparrows and the dry-ground dwelling Brewer sparrows.

Young song sparrows out of the nest were shot at the north end of Eagle Lake on June 17, 1928, and in Petes Valley in mid-July.

The relationships of the breeding song sparrows along our section are not quite clear, owing to lack of material which is perfectly comparable from the mid-portion of it. Suffice it to say that, while we put all the birds from the slope draining to the westward, into the

Sacramento Valley, under *mailliardi,* and all those in the Great Basin drainage under *fisherella,* there is very likely complete intergradation in characters between these races, not necessarily according closely with the topography, as just indicated hypothetically. The divides between the westward and eastward drainages are not well marked and have evidently shifted quite recently in some places. Anyway, there is even now no sharply determining factor to prevent settlement of appropriate habitats at very short intervals across the entire width of the mountains, especially along a line immediately south of Lassen Peak.

To repeat, the birds taken between Battle Creek Meadows and Warner Creek, and called *mailliardi,* are either juvenals or adults of such worn plumage as to be equivocal. They *may* be perfectly good intergrades—likely are.

Passerella melodia merrilli (Brewster)

Merrill Song Sparrow

Examples of the Merrill song sparrow were collected in mid-winter at the following places in the western end of the section: Cone's, 270 feet, December 28 and 29, 1927; Dale's, 600 feet, December 23 and 24, 1924; Elliott's, 1000 feet, December 25, 1927.

Weights of three males were 22.9, 24.3 and 25.0 grams (average 24). Eight females ranged in weight from 20.2 to 22.5 grams (average 21.2).

The birds collected were found in loose companies feeding with other sparrows in dense thickets of weeds on waste ground or in old fields.

Passerella melodia morphna (Oberholser)

Rusty Song Sparrow

Specimens representing this winter visitant race of song sparrow were obtained at: Coyote Creek, 270 feet, December 28, 1927; Cone's, 270 feet, December 28 and 29, 1927; Slate Creek, 5700 feet, September 28, 1924; five miles north of Fredonyer Peak, 5700 feet, September 30 and October 3, 1924.

Weights of two males, late September and December, were 21.5 and 22.2 grams, respectively. Two females, September and October, weighed 18.6 and 16.5 grams, respectively. Weights of a male and two females in December were 22.2, 20, and 22.3 grams.

Birds of this race noted were members of scattering droves consisting of this and other races of song sparrow foraging in the narrow belts of coarse grass bordering ditches and in weedy thickets on waste ground and in fields. As a rule, it was easy to distinguish individuals of *morphna* from the others at some distance by reason of their conspicuously dark general coloration.

It seems to us strange that individuals of this race, which breeds restrictedly within the humid coast belt of northwestern America, should have reached, even at the season of migration, so far over into arid Great Basin territory as to the eastward of Eagle Lake.

Passerella iliaca altivagans Riley

Alberta Fox Sparrow

Localities and dates represented by the eight skins of this winter visitant race of fox sparrow taken are as follows: Dale's, 600 feet, December 22 and 23, 1924; Inskip Hill at 2000 feet, December 26, 1927; Turner's, 3500 feet, April 27, 1928; Slate Creek, 5500 feet, September 26, 1924.

Weights of three males in December were 28.3, 29.4, and 29.6 grams; one taken in April weighed 34.4 grams. Three females in December weighed 25.7, 29.2, and 31.4 grams. A young female, September, weighed 29.1 grams.

In December, 1924, this race of fox sparrow was found commonly along with others in the vicinity of Dale's. When all the ground was covered with snow except beneath thick bushes and live oaks the birds scratched for food on these bare areas. At Turner's the fox sparrow taken was with others in manzanita and snow-brush. Songs of fox sparrows that were heard there in the evening possibly were given by birds of this race. The fall-taken bird from Slate Creek was shot at a spring.

Passerella iliaca schistacea Baird

Slate-colored Fox Sparrow

Five examples of this race were collected, at the following places: Inskip Hill at 1800 feet, December 22 and 23, 1927; eight miles east of Payne Creek P. O., 2800 feet, December 31, 1924; Drakesbad, 5500 feet, October 8, 1923.

An adult male, taken in October, weighed 32.4 grams. A female, December, weighed 30.5 grams.

Passerella iliaca fulva Swarth

Warner Mountains Fox Sparrow

Five specimens of fox sparrow taken from the breeding population in the vicinity of Butte Lake are identified as nearest, in characters, to the subspecies *fulva*, which most typically inhabits the Warner Mountains to the northeastward. These birds were found living in the shrubs and small conifers on the dry slopes just north of the lake. Another course might have been to list these Butte Lake birds under *mariposae,* with the comment that in characters they show strong tendencies in shape of bill and general size toward *fulva.* But there is no assurance that the fox sparrow population is continuous east from the Manzanita Lake neighborhood toward Butte Lake, nor northwest from Eagle Lake. It may be, in fact, that the continuity (as evidenced by the features of the birds taken) is more close toward the north.

Weights of four males collected in June were 29.6, 30.5, 30.7, and 32.1 grams. A female weighed 35.5 grams.

A female shot on June 20, 1926, was gathering insect food, presumably for young in a nest.

Passerella iliaca mariposae Swarth

Yosemite Fox Sparrow

Present in the section in summer from the vicinity of Battle Creek Meadows eastward as far as the edge of the Great Basin portion of the section, near Eagle Lake (fig. 116). Collected as follows: ridge northeast of Mineral, 5500 feet; Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lassen Peak at 9000 feet, May 17, 1924; Willow Lake, 5600 feet; Kelly's, 5200 feet, September 2 and 3, 1925; four miles west of the southwest end of Eagle Lake, 6800 feet; two miles east of Gallatin's, at 6400 feet. Observed also at the following additional places: Turner Mountain, 6300 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; on trail to Broke-off Mountain, 7000 feet; Broke-off Mountain at 8000 feet; Wilson Lake, 5000 feet; ridge south of Eagle Lake, 5800 feet.

On April 19, 1929, near Mineral, one fox sparrow was seen and others were heard calling in the snow-brush thickets (fig. 35) in the same places the birds nested in summer. These birds were thought to belong to this race and to be already settled for the summer season. Our next earliest date for the presence of this race on its summer ground near Mineral was May 8, 1927. The seasonally latest record was September 2, 1925, when specimens were taken at Kelly's.

The greatest numbers of fox sparrows in summer were found on those mountain slopes where snow-brush, tobacco-brush, and manzanita formed the conspicuous components of the vegetation (fig. 39). The species was present but in smaller numbers in the open woods where there were thickets of the same plants, or chinquapin, beneath the trees. Also, the birds were found to a moderate extent in clumps of willow and alder that grew at stream sources and in moist places which bordered streams.

Near Mineral, on July 26, 1925, service-berries were just turning reddish. Among other birds, fox sparrows were seeking eagerly and eating these fruits.

These sparrows chose for singing perches, when they were available, tops of stubs or the tips of small trees which projected above the tops of the bushes where the birds lived. When these high perches were not near, the birds would find singing perches close to the ground in the bushes. By the end of July songs were infrequent and broken. On September 2, 1925, at Kelly's the sparrows were giving fragments of the song at frequent intervals.

The earliest nest found, contained young birds on June 7, 1926. It was on a north-facing, chaparral-covered slope one mile south of Manzanita Lake. The nest was placed in a scratched-out hollow five centimeters deep. Its rim was even with the surface of the ground. When first seen the female was at the nest. The female ran off over the ground for about six meters before flying or making a sound. The male came near and called excitedly. When disturbed, the three young birds in the nest hopped out onto the ground and started to leave, each in a different direction. The nest was made almost entirely of fine material with a few coarse twigs in the outer frame (Linsdale, MS).

Several adults that were shot on June 8 were gathering insect food for young. One had in its bill two large ants and a caterpillar. One female shot that day contained a set of eggs, of varying sizes, nearly ready for laying.

Most of the fox sparrows' nests found were in the neighborhood of Mineral. On June 15, 1927, a newly completed nest was found but it was still empty. There were three eggs on June 18, a completed set, since the number was the same the next day. The bird came about the nest when the eggs were removed on the 19th. The nest rim was 23 centimeters above the ground. The site was within a great mass of blossoming snow-brush, the nest resting on a horizontal dead mass of old snow-brush branches, and well sheltered above by slanting live branches.

A nest containing three fresh eggs was found on June 16, 1925. It was 49 centimeters up in a bush of snow-brush in a large tract of that plant. Two slanting green stems partly shaded the nest from above, and a small, dead pine stem stood up through the tangle 25 centimeters away. The brooding female was so shy it would not come to the nest when a camera was set up near there.

In early June, 1925, a pair of fox sparrows was seen daily feeding about a camp site at Mineral. On June 16 their nest was found, 36 centimeters above a mat of yellow pine needles, amid rather spare stems of snow-brush. The nest was coarsely made of pine and other twigs externally, and lined with shredded bark. The male frequently sang from a young fir tip scarcely three meters directly above the nest, as well as from the brush all about it and even when hopping on the ground between or through the bushes.

When first found, this nest contained two young thought to be about three days old, helpless and downy rather than feathery. The female showed much concern and came within two meters of the observers. The male was indifferent and sang as soon as the observers withdrew. On June 17 the happenings at this nest were watched for most of the day. The female did most of the feeding of young, making trips at intervals of from two to five minutes. Twice the male brought food for the young. When the nest was in the sunshine the panting female shaded it with spread wings. All the feces were eaten by the parent. (See fig. 147.)

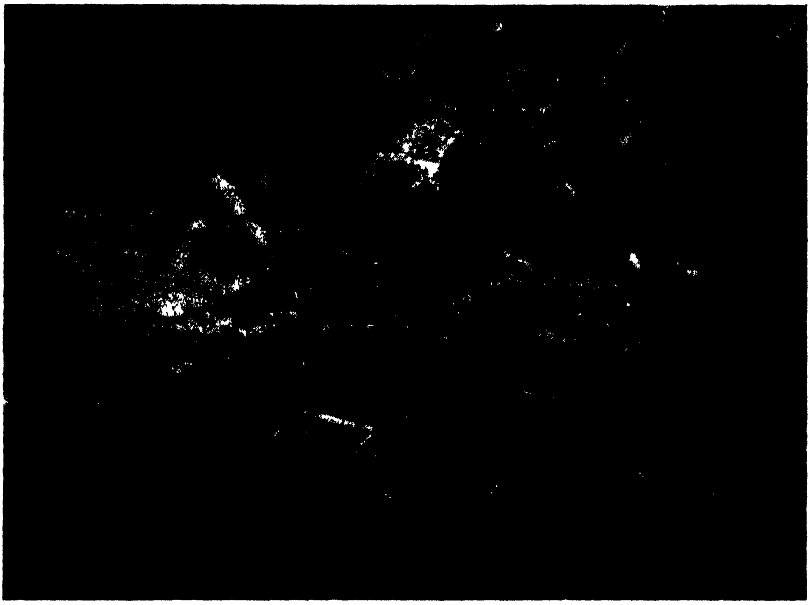


Fig. 147. Yosemite fox sparrow (*Passerella iliaca mariposae*) perched at edge of nest in snow-brush. The nest contained two young birds. Photograph taken June 19, 1925, at Mineral. Mus. Vert. Zool. no. 4650.

This female was watched caring for the young on June 21. It worked about the person seated close by, continually picking up small objects and uttering a faint *seet*. The wing ends were drooped and the tail was raised free of the ground; often it was turned somewhat at an angle sideways from the axis of the body. The male hopped about farther away, at a three-meter radius, and uttered a much louder metallic *klink*—then broke into full song. All the food was gathered within a radius of three meters of the nest.

Another nest containing nearly grown young birds was watched on June 21, 1925. The female foraged within eight meters of the nest, but the male went farther, sometimes twice that distance, to get food. The male was seen to gather insects and carry them to the female which took them in her bill and then carried them to the young birds. Although some of the food was obtained from among the leaves on the ground, most of it was picked off the growing vegetation. Twice the female picked off bits of green leaves of miner's lettuce (*Montia*) and fed them to the young. The remainder of the food was made up of insects. It looked to the observer as though the birds saw the insects best when they were between 15 and 30 centimeters distant.

A fox sparrow's nest that was found June 19, 1925, contained two half-fledged young which left when the nest was looked into. They were tolled out by the frantic actions and voicings of the two parents, which flopped along the ground under and through the bushes, giving their *klink*s in rapid succession. Other sympathetic fox sparrows came near. The rim of this nest was 53 centimeters above the ground. The structure was in a tangle of dead twiggery, in part supported by slanting snow-brush stems, in a thicket of the same, well shaded by the green leafage above.

June 22, 1925, a nest was discovered on a ridge east of Mineral. This one held three young which left their nest when disturbed and followed the parents off in different directions. The nest was in a low, snow-flattened thicket of snow-brush, on open forest floor with incense cedar and yellow pine overhead. The rim was 14 centimeters above the ground. The nest was less bulky than usual, resting on a tangle of snow-brush stems and twigs mixed with yellow pine needles, so that there was really no space between it and the ground. The lining was mostly of fine, round grasses, with no bark strips.

Two miles west of Black Butte on June 27, 1924, a fox sparrow's nest was found in a strip of alders bordering a small stream. The nest was 30 centimeters above the ground, between stems of alder. The four young jumped out of the nest when disturbed and would not stay in it when replaced. On the following day another nest was found in a similar place. This one was situated directly on the ground. It contained one egg and one young bird.

Passerella iliaca megarhynchus Baird

Thick-billed Fox Sparrow

Found in winter, apparently common, in the western part of the section, where sixteen specimens were obtained as follows: Inskip Hill at 1800 and 2000 feet, December 22, 23, and 26, 1927; Payne Creek P. O., 1600 feet, December 22, 1927; Manton, 2300 feet, April 20, 1928.

Weights of three males in December were 31.2, 31.9, and 34.8 grams. An April-taken male weighed 35.7 grams. Four females in December weighed 28.2, 28.4, 28.5, and 30 grams.

On the sides of Inskip Hill in December, 1927, this race of fox sparrow was the commonest one among the five races found to be present. The birds were seen most often beneath the fruiting bushes of manzanita and the thick clumps of scrub oak. Between the oak clumps the ground was bare and grassless, just pumice pebbles, but beneath the clumps the level was raised by deep accumulations of leaf litter (fig. 42), and in this the fox sparrows were vigorously scratching. One individual under a manzanita bush was watched from within three meters' distance. At frequent intervals the bird picked objects from the depression in which it was scratching, and which had been formed at least in part through this activity. The observer could hear the sounds made in cracking a seed or berry in the bird's bill.

At Manton, April 18, 20, and 21, 1928, fox sparrows were observed. The one specimen saved from there belonged to this race. The birds were beneath scrub oaks. Several were heard singing. One was singing a low, soft "whisper-song." It was thought these birds were on the eve of departure for the (as yet unknown!) summering ground of this subspecies.

Our December-taken specimens established a wintering ground for *megarhynchus* considerably to the northward of what has been known for it heretofore (see Swarth, 1920, pp. 161–165).

Passerella iliaca annectens Ridgway

Yakutat Fox Sparrow

Three specimens representing this winter visitant race to the section were preserved from: Elliott's, 1000 feet, December 25, 1927, and Inskip Hill at 2000 and 3000 feet, December 26, 1927. Weights of the three, all males, were 34.7, 38.9, and 40.7 grams.

The bird at Elliott's was in a dense thicket bordering a creek. The one from the top (3000 feet) of Inskip Hill was in a brush pile. Other fox sparrows that were seen that day were down on the brushy slopes, several hundred feet lower.

Passerella iliaca sinuosa Grinnell

Valdez Fox Sparrow

Seven specimens were obtained in winter and at the following places: Cone's, 270 feet, December 29, 1927; Dale's, 600 feet, December 22, 1924; Inskip Hill at 1800 and 2000 feet, December 23 and 27, 1927; Warner Creek at 6600 feet, September 28, 1923.

Weights of five males were 31.2, 31.2, 31.9, 37.7, and 40.1 grams. A female weighed 28.5 grams.

Individuals of this race were found in weed patches and beneath clumps of buck-brush and manzanita.

Passerella iliaca unalaschcensis (Gmelin)

Shumagin Fox Sparrow

A single specimen identified as of this race (no. 45759) was obtained from Dale's, 600 feet, December 26, 1924. It was a female, weight 31.3 grams. This bird was alone beneath a clump of buck-brush.

MAMMALS

Scapanus latimanus latimanus (Bachman)

Central California Mole

This race of mole came into the western end of the section on the floor of the Sacramento Valley (fig. 106). Specimens were trapped at Red Bluff, 300 feet, and Cone's, 270 feet. Ridges made by moles were seen on Blue Tent Creek, on Mill Creek, and at several other places near the Sacramento River.

A male, trapped at Red Bluff, May 4, weighed 68.5 grams.

Ridges made by moles in the western part of the section were seen most often on the sandy soil close to the streams. In May, 1924, an island in the Sacramento River, above Red Bluff, had workings of mole on it. This island showed evidences of complete inundation at times of high water.

On May 4, 1924, the following experience was had with a mole on the east bank of the Sacramento River a mile or so above Red Bluff. Fresh ridges and hills were found in the damp sandy ground under willows within a few yards of the water's edge. "Macabee"-type traps were set with due care, two of them, in opposite directions in a surface "run"; but each time they were visited it was found that the mole had traversed a new route leaving a hole *around* each trap. Either the "feel" of the steel wires, or odor pertaining to them, was evidently repellant, with the result that in this case the mole avoided capture. Finally the observer, after opening up a section of "run" and filling the trough with loose earth, stood by quietly. The animal proved to have been on the far side of the opened section from its evident headquarters (indicated by several hills) and so was restless to get back "home." At the end of less than five minutes the earth in the far end of the filled-in trough began to move, and the mole proceeded to "swim" along its original route under the loose soil; then it was scooped out by a quick movement, on the part of the observer, with the hands aided by an iron spoon. When handled, the mole gave a "gritty squeal," and tried to bite.

Scapanus latimanus dilatus True

Klamath California Mole

Widely distributed over the middle portion of the section, occurring westward from Fredonyer Peak to as low as Dale's (fig. 106). Specimens represent the following places: Dale's, 600 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Lake Helen, 8200 feet; Drakesbad, 5500 feet; Eagle Lake Resort, 5200 feet; five miles north of Fredonyer Peak, 5700 feet.

Weights of males in the section were as follows: Dale's, May, 73 and 83 grams; Battle Creek Meadows, June, 74.5; Lake Helen, July, 55; Eagle Lake Resort, May, 64, 65, and 69, June, 67; five miles north of Fredonyer Peak, October, 83. The weights for females listed below are consistently less than weights of males from the same places: Dale's, May, 53; Lyman's, June, 64; Turner's, April, 66; Mineral, May, 75; Drakesbad, September, 75.7; Eagle Lake Resort, June, 56; five miles north of Fredonyer Peak, October, 78.

Evidences of the work of moles were found in the section most often on ground close to streams or in the drier portions of meadows (fig. 148). Close to Pine Creek near Eagle Lake numerous ridges made by moles were seen beneath the thick leaf litter in a grove of aspens (fig. 49).

A mole at Dale's, May 19, 1924, was found dead in the well at the house.

At Mineral, on the evening of May 16, 1924, fresh mole workings were found in a meadow, and presently the observer's attention was called to an actively rising ridge in the grassy sod under a veratrum plant. The movement of the grass and ground surface was accompanied by distinct though "muffled" sounds, like that of the tearing of roots, as the animal moved along. Repeated attempts to waylay this mole failed, it evidently retreating quickly when the jar of footfalls, however lightly made, were felt. A trap set in the run overnight caught the animal.

A mole ridge near Drakesbad, September 7, 1923, was flattened down, by the observer using his foot, and then watched. By the movement of the earth, the mole was presently seen to arrive at one end of the pressed-down section, hesitate, and then retreat. Soon it returned and began to raise the earth along the flattened route, which

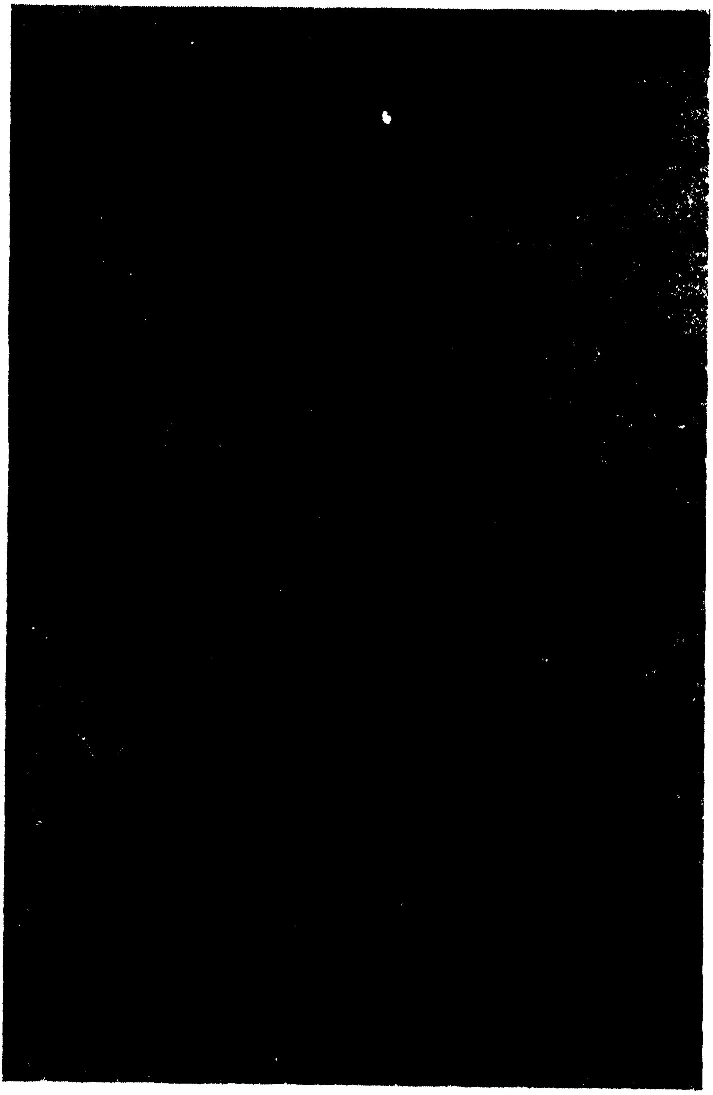


Fig. 148. Mounds made by Klamath moles (*Scapanus latimanus dilatus*) in edge of a meadow soon after the snow had melted in spring; also shows scant remains of dried-up vegetation of previous year's growth, before new spring growth had started. Photograph taken April 19, 1929, at Battle Creek Meadows. Mus. Vert. Zool. no. 5865.

cracked and "ridged up" slowly, at the rate of about two feet per minute. When the mole had nearly reached the other end of the flattened section of "run," it was flipped out with an iron spoon.

The nineteen specimens of moles preserved from the Lassen section fall definitely, on characters of general size, color-tone, and cranium, into two geographic groups. Those captured at Dale's (only 600 feet altitude) are quite as positively *Scapanus latimanus dilatus* as those from places listed above from the farthest eastward localities. They are sharply different, especially as to cranial features, from our three examples from the Sacramento River bottomlands, these three in turn being inseparable from *S. l. latimanus.* This state of affairs accords with the conclusions of Jackson as set forth in his Review of the American Moles (1915). The point of note here is that *if* intergradation takes place within our section between the races *latimanus* and *dilatus,* it must occur within the narrow width of territory, certainly less than ten miles, between the eastern edge of the Sacramento River bottom and Dale's, on Paine's Creek. But Paine's Creek below Dale's flows through a narrow, rock-walled gorge, where conditions look unfavorable to the existence of any moles. So there may be an actual no-man's-land at this latitude between the ranges of *latimanus* and *dilatus.*

Neürotrichus gibbsii gibbsii (Baird)

Gibbs Shrew-mole

Trapped at: Lyman's, 3300 feet, June 14, 1924; Summit Creek, 5200 feet, June 23, 1924; two miles west of Black Butte, 6800 feet, July 5 and 7, 1924. Weights of the four individuals obtained, all males, were as follows: 9.1, 11, 11.1, and 12 grams.

The shrew-mole that was trapped at Lyman's was caught on a moist bank beneath some willows. Three white-footed mice (*Peromyscus maniculatus gambelii*) had been caught previously in the trap set at this same place. After the shrew-mole was taken a small burrow was found directly beneath the trap. The specimen from Summit Creek was trapped at the edge of the stream in a washed-out place in the bank. One of the animals from near Black Butte was caught among rocks covered with green plants and at the base of a bank 60 meters high, over which a stream falls in wet years. The other was trapped under a dry log among red firs within twenty meters of a stream. This one was caught in the daytime and its nose and feet had been badly chewed by ants before it was removed from the trap.

Sorex trowbridgii mariposae Grinnell

Yosemite Trowbridge Shrew

This species was trapped by us at stations in the mountainous part of the section from the 3300-foot contour line eastward to the edge of the Great Basin. All records are for stations below 7000 feet altitude. Specimens represent the following places: Lyman's, 3300 feet; two miles northeast of Mineral at 5500 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet; Willow Lake, 5600 feet; five miles north of Fredonyer Peak, 5700 feet.

Situations in which shrews of this species were trapped are as follows: under willows near creek; in "runway" at edge of creek; on muddy ground under log at edge of creek; in seepage under alders; in mossy nook among stones and seepage; in small tule clump at edge of lake; under rocks at base of falls; under log on dry hillside near lake; in open place on hillside among firs, ground covered with dry fir needles, soil fairly dry, ten meters from creek; at base of fir tree thirty meters from creek; in *Microtus* runway in dry grass thirty meters from water; in dry leaves under big fallen tree; beneath rotten log in dry woods of yellow pine, white fir, and incense cedar.

At Lyman's two individuals of this species were caught in a trap in a runway at the edge of a small stream. Previously, in the same trap in the same runway three Gambel white-footed mice and one shrew-mole had been taken. This species appeared to be much less closely dependent upon the presence of water within the habitat of each individual than was *S. v. amoenus.* However, no sharp distinction is to be made out from our field notes by which the habitats of the two can be separately defined.

On July 29, 1925, at the side of a trail near Mineral a shrew was seen to scurry along the side of a rotten log and across a small open space whence it disappeared under a slab of wood. When the slab was lifted the animal was captured by hand. Here was a case of a shrew venturing out into the open close to noon of a brilliantly sunshiny day. This one proved to be a suckling female. Several other individuals in different places were trapped in the daytime.

Sorex vagrans amoenus Merriam

Sierra Nevada Wandering Shrew

This shrew was recorded in the higher parts of the section up to 8200 feet altitude, from Turner's on the west to the neighborhood of Willow Lake on the east. Specimens were preserved from the following places: Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet.

Individual shrews of this species were trapped in the following kinds of places: beside rock at edge of lake; under alders at edge of lake; in moss at boggy lake; in rank grass under willows in bog; in *Microtus* runways in mossy bog and at edge of meadow; under log on dry hillside. In nearly all these sites of capture water formed a conspicuous part of the immediate surroundings.

Two females trapped at Willow Lake, July 18 and 22, 1924, contained five and nine embryos, respectively (Borell, MS).

Many of the individuals trapped were caught during the daylight hours.

At Willow Lake a garter snake was found, July 25, 1924, eating a dead shrew that was held in a mousetrap.

Sorex ornatus californicus Merriam

California Long-tailed Shrew

In May, 1926, an accumulation of pellets of barn owl (*Tyto alba pratincola*) was gathered from the floor of a barn near Bloody Island, within a mile of the Sacramento River, and on the east side of it. These pellets to the number of 67 were subsequently dissected, and out of a total of 126 individual mammals represented, just one was found to be other than rodent or lagomorph. This was a shrew represented in one pellet by the skull, including the mandibles, but with most of the braincase wanting; the teeth are in unworn condition.

The cranium offers the following measurements, in millimeters: palatal length 6.4, interorbital breadth 3.5, maxillary breadth 4.8, maxillary tooth-row 5.5. In comparison with the condition in the "*vagrans-obscurus* group" (see Jackson, 1928) the frontal slope of the cranium is low; in other words, the skull is of the relatively "flat" type as in the "*ornatus* group." The unicuspid teeth are relatively narrow and weak, the third decidedly smaller than the fourth, rather than these two teeth being subequal.

Our examination of this skull, bringing out the above facts, leads us to regard it as belonging to the "*ornatus* group" of long-tailed shrews, and from geographic considerations further to restrict it to the subspecies *californicus*. These geographic considerations are as follows:

(1) The place of capture of the shrew in question, by the owl, would not likely have been farther than three miles from where the pellet was found.

(2) No specimen of *Sorex* is known from this portion of the Sacramento River valley. The nearest station where we trapped shrews was Lyman's, 22 miles away air-line, and nearly 3000 feet higher in elevation; moreover, in a different life-zone, Transition instead of Lower Sonoran or low Upper Sonoran. The shrews taken at Lyman's were definitely *S. trowbridgii mariposae*.

(3) The nearest known low-zone kind of shrew to the place where the owl pellet was found is *Sorex ornatus californicus*, which has been recorded (Jackson, *op. cit.*, p. 169) from both sides of the Sacramento Valley as far north as Rumsey, Yolo County, and Auburn, Placer County.

(4) Jackson (*op. cit.*, p. 170) describes another form in the "*ornatus* group," *Sorex trigonirostris*, from Ashland, Oregon, based on two specimens; and he remarks that this species seems closely related to *ornatus* and that additional material may prove intergradation through *californicus*.

(5) Our specimen comes from a place between the type locality of *trigonirostris* and the northernmost record stations of *californicus* —more within the assumable range of the latter.

Sorex palustris navigator (Baird)

Mountain Water-shrew

Found in the mountainous portion of the section from Manzanita Lake to Kelly's, and up to 8200 feet altitude. Specimens collected at the following stations: Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet. A single individual was observed in Mill Creek at 7000 feet.

Weights in grams of twelve males from the section averaged 11.1 (8–15). Five females in which no embryos were found averaged 10.7 (8.3–15) grams in weight. Although in this series the males thus average slightly heavier than the females, the range of weight is seen to be practically the same in both sexes.

Every individual of this species that was encountered was either in or at the edge of the water. In the water they swam beneath the surface; encountering obstructions, such as drift or stones, they crawled up and over these. At the station two miles west of Black Butte one was seen, June 30, 1924, making its way up a small stream. Wherever possible, it traveled on the ground, but it took to the water where the bank became too steep. Within a few minutes another individual came along, following the path of the first. Traps that caught this species of shrew were usually those that had been set at the edge of a stream or on accumulations of drift just above the water. At Lake Helen and at Willow Lake individuals were trapped at the edges of the lakes. One at Willow Lake was caught out in the water on a log. In some wet bog-like ground close to this lake one was caught in a trap placed under a log. Along Manzanita Creek, June 6, 1926, a female was trapped at the opening of a small tunnel at the edge of the stream. This tunnel, except for its smaller size, appeared much like the ordinary surface tunnel of a mole.

Active individuals were observed at various times of the day, and on at least five occasions; twice animals swimming after dark were seen by the aid of light reflected from a camp fire. When seen under water the animals appeared silvery, due to the air contained in their fur.

At two miles west of Black Butte, on June 30, 1924, a female that had taken refuge under an overhanging bank of a stream was captured alive in the hand. Another female was caught at the same place a few minutes later. The two animals were placed together in a box. They began fighting immediately, the one on the defense throwing itself on its back. When fighting they made a shrill, scrapy sound, *dzeet dzeet*, which was something like the sound made by certain bats. One of these animals died and the other escaped before the end of the first night after capture. Two males that were captured alive by hand at the same place in the evening of July 7 were placed in separate boxes with nest material. On the next morning both were dead (Borell, MS).

All the individuals that were handled alive attempted to bite their captor, but not one was able to bite through the skin of a finger. It was especially hard to hold these animals since their skins are so loosely attached that they are able to twist their bodies about actively within them.

Some of the animals (both sexes) that were handled gave off a strong odor which to one observer (Hunt, MS) seemed "skunky." In others of the shrews that were handled in the same season, no trace of the odor could be detected.

A shrew that was trapped at Lake Helen, July 14, 1924, had been torn open and partly eaten by some animal before the trap was visited in the morning.

Trapping records indicate that this species is of infrequent occurrence in the section, but that it was more numerous two miles west of Black Butte than at any other station. There, seven males and two females were captured between June 28 and July 8, 1924. At Willow Lake four were captured from July 20 to 24, 1924. Not more than one specimen was obtained at any one of the other stations of capture. The latest fall record of activity of this animal is for October 4, 1923, when one was captured at Drakesbad.

The greater number of males, twelve out of seventeen, in the series of specimens taken, might indicate a tendency on the part of that sex to wander more widely than the females.

Myotis lucifugus carissima Thomas

Yellowstone Little Brown Bat

Found only in the higher mountainous portion of the section. Specimens represent the following localities: two miles west of Black Butte, 6800 feet, June 30, 1924; Warner Creek at 8000 feet, September 10 and 11, 1923; Willow Lake, 5600 feet, July 19 and 22, 1924; Butte Lake, 6100 feet, June 27, 1928.

Weights of the five males obtained averaged 6 (4.4–8.4) grams; two females weighed 6.3 and 6.8 grams, respectively. The smaller of these last, taken June 27 at Butte Lake, contained one large embryo.

At Butte Lake, where specimens as indicated above were shot, large numbers of smallish bats appeared at late dusk over the water, in places which were sheltered from the westerly wind. At the head of the western "bay" close to the lodgepole pines and aspens, there was a bewildering whirl of them, dipping to the surface presumably to drink, and hawking for the numerous small insects to be seen over the water. From the suddenness of appearance of the bats each evening, and their numbers, it was surmised that they had their daytime roosting places in the near-by broken-to-pieces lava face (Grinnell, MS).

Myotis yumanensis sociabilis H. W. Grinnell

Tejon Yuma Bat

An individual of this species was caught in a house at Dale's, 600 feet, on the evening of June 3, 1924. It was a female which weighed 6.4 grams. At Elliott's, 1000 feet, a female was captured June 5, 1924, between two rafters of a barn. Afterwards, on the day of its capture, this individual gave birth to a young one.

Myotis evotis chrysonotus (J. A. Allen)

Golden Long-eared Bat

Specimens were preserved from: Antelope Creek at 3000 feet, June 7, 1924; two miles west of Black Butte, 6800 feet, June 27 and July 1, 1924; Warner Creek at 8000 feet, September 9 and 10, 1923.

Weights, in grams, of three females were: 5.0, 5.7, 8.0. Two males, taken in September, weighed 5.3 and 6.8 grams, respectively.

The female that was captured on Antelope Creek was found in the daytime among the timbers of an unused railroad trestle.

Myotis volans interior Miller

Interior Long-legged Bat

A single specimen was obtained at each of the following three stations: Warner Creek at 8000 feet, September 10, 1923; Drakesbad, 5500 feet, September 7, 1923; five miles north of Fredonyer Peak, 5700 feet, September 29 and 30, and October 1, 1924.

Three of the individuals taken were males whose weights were: 6.0, 6.3, 6.4 grams; two were females which weighed 5 and 9 grams.

Myotis californicus californicus (Audubon and Bachman)

Southern Little California Bat

Specimens were preserved from the following localities: Dale's, 600 feet, May 25 and 26, 1924; Manton, 2300 feet, May 30, 1926; two miles west of Black Butte, 6800 feet, June 29, 1924; Warner Creek at 8000 feet, September 10, 1923.

Three females weighed, in grams, 4.1, 5.1, 5.6; a male weighed 3.6.

Two individuals were discovered, May 25, 1924, clinging to the timbers beneath a low bridge over a dry wash near Dale's. A young one was found clinging to a rock close by. At Manton, individuals of this species subsequently collected were seen to fly about and through a barn just at dusk.

Myotis subulatus melanorhinus (Merriam)

Black-nosed Bat

A single specimen was obtained, shot on the evening of July 15, 1928, in Petes Valley, 4500 feet altitude. It was a female and weighed 4.7 grams.

Lasionycteris noctivagans (LeConte)

Silvery-haired Bat

Single individuals were taken at each of the following localities: Antelope Creek at 3000 feet, June 7, 1924; Battle Creek Meadows, 4800 feet, June 24, 1924; Willow Lake, 5600 feet, July 25, 1924. Specimens from the two last named stations were females which weighed 13.9 and 11 grams, respectively.

The male that was obtained at Antelope Creek was taken in the daytime from its resting place in the same trestle and six meters away from the golden big-eared bat which was also collected at that place. The bat from Willow Lake was shot as it flew, at dusk, high over a meadow.

Pipistrellus hesperus merriami (Dobson)

Merriam Western Bat

Three females of this species were obtained at Dale's, 600 feet. Each was shot at dusk, one flying over a road and another over a potato patch. Each contained two embryos. Dates of collection were May 21 and 25, and June 3, 1924. Weights were 4, 4.5, 5.2 grams.

The type specimen of this subspecies is stated (Miller, 1897, p. 31) to have come from Red Bluff. But no information as to how, when, or by whom it was obtained is available to us.

Eptesicus fuscus fuscus (Peale and Beauvois)

Large Brown Bat

Most widely distributed and most frequently captured species of bat in the section. Specimens obtained from following localities: Red Bluff, 300 feet, May 10, 1924; Bloody Island, 350 feet; Tehama, 250 feet; Mill Creek, 260 feet; Dale's, 600 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet, September 9 and 11, 1923; Spalding's, 5300 feet, October 13, 1923; Slate Creek, 5700 feet, September 26 and 27, 1924; eight miles southwest of Ravendale, 5600 feet, July 17, 1928. Only the significant dates of capture, seasonally, are here cited.

Weights in grams of five males average 17.4 (14.6–22.7); of eleven females, 16.8 (12.8–21.5). Since it is known that some of the females in the series contained embryos, it seems evident that at non-breeding seasons of the year the males would average heavier than the females.

Large brown bats were most often obtained by shooting individuals that were seen flying at late dusk. Some were found with many free-tailed bats among the timbers of a railroad bridge at Tehama. Another colony was located in a crevice in the roof of a barn at Dale's. A female collected at Tehama, May 14, 1924, contained a single embryo. Each of five females taken from a barn at Dale's, May 29, 1924, was carrying a single young one. In one case the young one weighed 7 grams.

Nycteris borealis teliotis (H. Allen)

Western Red Bat

A single specimen collected at Dale's, 600 feet, at 7:40 p.m. (early dusk) on May 19, 1924. It was a female, weighing 15 grams, which contained three embryos that, together, weighed 4.3 grams. This bat was shot as it flew, erratically, among live oaks, mostly below the level of the treetops (Grinnell, MS).

Corynorhinus rafinesquii intermedius H. W. Grinnell

Intermediate Lump-nosed Bat

Only record for the section is a male, weight 11 grams, that was found in the daytime, May 27, 1926, in a barn near Bloody Island, 350 feet.

Antrozous pallidus pacificus Merriam

Pacific Pallid Bat

Near Dale's in mid-afternoon of June 2, 1924, a hot day, a female Pacific pallid bat was seen to fall to the ground from a clump of dead branches on the west side of the crown of an oak tree. Apparently the animal was unable to fly, as it only fluttered along on the ground. On the following morning this individual bore two young, one of which was dead, when found, the other living. At 9 p.m. the parent had escaped from its box, but two hours later, when the box was examined, it had returned and the young one was suckling. While the parent was away the young one had made a continuous squeaking sound (Borell, MS). The female, subsequent to the birth of the young, weighed 19 grams.

Tadarida mexicana (Saussure)

Mexican Free-tailed Bat

Found only in the western and lower portion of the section, where specimens were collected at the following places: Tehama, 250 feet, May 14, 1924; Elliott's, 1000 feet, June 5, 1924; Manton, 2300 feet, June 2 and 4, 1926.

Weights of three males were 12, 12.4, and 13 grams. Three females weighed 13.5, 14, 15.3 grams. Each of the three females collected (two at Tehama and one at Manton) contained a single embryo.

At Tehama a colony of nearly five hundred bats, chiefly this species but with some large brown bats also present, was found occupying crevices of a railroad bridge. The animals were hanging in clusters, but each species kept to itself. Of the present species, two females and two males were obtained from this colony.

All of the six individuals taken at Elliott's were males. There they were roosting in a barn, between parallel rafters that were 25 millimeters apart.

The single female collected at Manton was clinging in a crack between boards forming the outer wall of a shed. Other bats occupied similar roosting places in the same building. A male was shot at that station as it flew in the evening over an orchard.

Ursus americanus californiensis J. Miller

Sierra Nevada Black Bear

We, ourselves, observed no direct evidence of the occurrence of bears in the section; but testimony of persons living in the region indicated that the black bear was present from as far eastward as Eagle Lake west to low altitudes in the cañons on the piedmont. Many persons told us of seeing bears or tracks of them in the section, and we were told of several of the animals being shot or trapped within recent years.

The most specific information given us was furnished by Mr. Ted Wells, experienced trapper with headquarters on Battle Creek Meadows. According to this informant, bears are quite variable, in numbers in evidence, from year to year, due, it is thought, to variation in local movements as governed by the varying of the acorn crop at the middle altitudes. In the winter of 1920–21, "about November," many bears appeared in upper Martin Creek cañon. Judging from the general trend of their tracks, they were all headed toward the high country about Broke-off Mountain. In this area the bears "hole up." That year, because of the heavy acorn crop, they had "stayed late" on the lower western slopes. In November, 1926, one bear came to Soupan's Camp, on the south side of Battle Creek Meadows, attracted by deer heads and other refuse thrown out there. In the fall of 1925, Mr. Wells caught two in regular bear traps on the ridge toward Morgan's from Battle Creek Meadows. In some years some bears are said to be active all winter.

Game Deputy Harry Brittan told us of an adult pair with two cubs that were killed up Mill Creek some fifteen miles east of Tehama, about December 1, 1927. Mr. George Collins reported having seen bears in summer in Mill Creek cañon at the base of Black Butte. In Hot Spring Valley (Drakesbad) it was reported by old-timers that bears are about as common now (that is, 1923) in that neighborhood as they ever have been.

Ursus klamathensis Merriam

Klamath Grizzly

That the grizzly bear once occurred widely within the Lassen section there can be little doubt. No specimen or even fragment of one from there is, however, known to us to have been preserved; the use of the name *Ursus klamathensis* for the race represented there is thus merely presumptive, though, we think, on quite good "geographic grounds."

Dr. J. S. Newberry (1857, pp. 47–48), reporting upon his journey through the region the last of July, 1855, makes the following statements. Grizzly bears

> are rather unpleasantly abundant in many parts of the Coast Range, and Sierra Nevada, in California, where large numbers are annually killed by the hunters, and where not a few of the hunters are annually killed by the bears. About Shingletown and McCumber's flat [on Battle Creek], northeast of Fort Reading, and around the base of Lassen's butte, they are very numerous. This region is partially covered with a forest of rather scattered trees . . . . , with wide intervals covered with a dense growth of *manzanita*, *ceanothus*, and low scrub oak. These thickets are the favorite haunts of the bear, and are intersected in every direction by their well-beaten paths. After crossing the divide [Noble's Pass] and descending into the interior basin, from which Pit river issues through its lower cañon, grizzly bear "signs" became more rare. . . . .

Townsend (1887, p. 183) states that while he was "in Lassen County [in 1884], several hunters reported the presence of a very large Grizzly along the eastern slope of the mountains in June."

All the other old-time statements we have seen, such as those of Fairfield (Pioneer History of Lassen County, 1916), are more or less vague; they pertain either to territory not definitely within the limits of our section, or there is some chance of the "cinnamon" phase of black bear having figured rather than the true grizzly.

Mrs. Creath Dale informs us (1924) that the house in which she now lives was built in 1862, and that she had been told by a former occupant of that house, a woman who came to live there in that year, that then or during subsequent years she had "looked out of the window" and seen "bears eating the wild grapes." This story is most likely, we think, to have pertained to the grizzly type of bear.

Procyon lotor psora Gray

California Coon

Specimens represent the following localities: Red Bluff, 300 feet; Dale's, 600 feet; Willow Lake, 5600 feet; Spalding's, 5200 feet. In addition, tracks were seen at: Mill Creek, 260 feet; Manton, 2300 feet; Morgan Hot Springs, 4800 feet; Crumbo Lake, 7210 feet; Warner Creek at 6000 feet; Kelly's, 5200 feet; Eagle Lake Resort, 5200 feet; Gallatin's, 5200 feet. A skull was seen on the floor of Petes Valley, 4500 feet.

A male that was obtained in May at Dale's weighed 12 pounds; one in January weighed 14 pounds. Three females trapped during the third week of October at Gallatin's weighed 4.5, 12, and 18 pounds, respectively; the first of these individuals was a young one and the third was exceptionally fat.

Tracks of this animal were most frequently observed in the belts of mud bordering streams, ponds, or lakes. Other types of situation in which tracks were noted are the following: on island in river; through a clump of willows; in a potato field; in a dusty trail on a side-hill among white firs. At Morgan Hot Springs fresh tracks of coons were seen in the mud on the warm, snow-free ground, December 21, 1927; but tracks were not seen in the snow which covered the surrounding country.

In two places near Eagle Lake accumulations of droppings were found, in October, 1923, which indicated that these places had been used regularly. At one place on a log there were fifteen or twenty deposits. The other station was at the base of a burned-out stub. Fish bones and scales, and bird bones and feathers, made up most of the material in these droppings (Dixon, MS). A trap placed beside the burned stump caught an old female coon. (See fig. 149.)

Around Eagle Lake it was noted that coons congregated along those portions of the shore line where ducks and other waterbirds were most numerous. Presumably they lived on birds wounded and lost by hunters or which died from other causes. Bodies of coots were used as bait for the coons caught there.

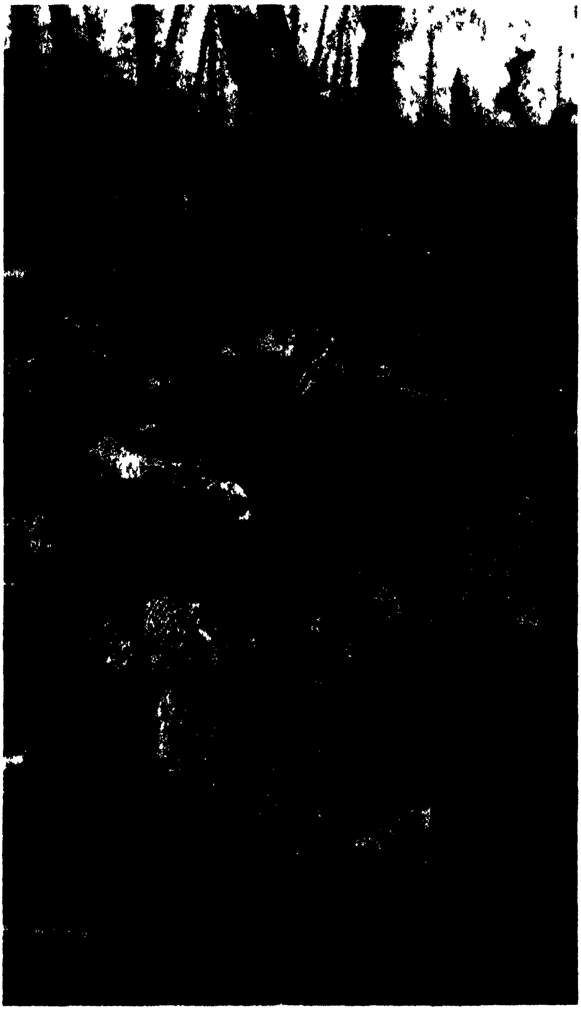


Fig. 149. A hollow log in the stub-forest near Eagle Lake, used as a den by a coon (*Procyon lotor psora*). Many of the dead trees had fallen and provided shelters such as this one, which were taken advantage of by ground prowling mammals. Photograph taken May 27, 1925, at Eagle Lake. Mus. Vert. Zool. no. 4672.

Among the stomach contents of a coon trapped at Dale's in May were parts of crayfish. The stomach of one trapped at Willow Lake in July contained parts of a freshly killed pocket gopher; even the skin and bones had been eaten, and one foot and the tail were intact.

A female trapped on October 19, 1923, at Eagle Lake was approximately one-third grown, weight 4.5 pounds, and indicated probably a late date of birth.

Available information concerning the number of coons in the section shows that the species occurs most plentifully along the Sacramento River and about the sloughs and streams in its immediate valley. (See fig. 47.) Higher in the foothills and mountains evidence of occurrence was not so frequently encountered. Away from the river the locality of most frequent occurrence was Eagle Lake. There one trapper had caught eight coons during the 1920–21 trapping season.

Bassariscus astutus raptor (Baird)

California Ring-tailed Cat

Found along the streams on the western slope of the section. In January and February, 1925, a female and two males were obtained by trappers along Paine's Creek between two and one-half and three miles west of Dale's and sent fresh to the Museum. The female weighed 2½ pounds. Weights in grams of the two males were 1055 and 1105 (about 2⅓ and 2½ pounds). One skin was obtained from a trapper who took it in the 1924 season on Battle Creek, nine miles east of Payne Creek P. O. Mr. Ted Wells told us that in the winter of 1920, at a time when the snow was nine feet deep, he caught a ring-tailed cat on Mill Creek near Morgan.

Martes caurina sierrae Grinnell and Storer

Sierra Pine Marten

Evidence obtained in our section showed presence of this mustelid only at localities from Broke-off Mountain at 8000 feet to Eagle Lake. Two specimens, male and female, were obtained on Warner Creek at 6600 feet. On June 17, 1925, freshly made tracks of marten were seen in snow on Broke-off Mountain at 8000 feet. Mr. Ted Wells of Mineral reported that six or seven were trapped at the head of Battle Creek during the winter of 1926. Two individuals, at least, were trapped for fur at Eagle Lake in 1921.

Mr. R. N. Book, of the National Park Service, told us in 1929 that two years previously martens had been fairly common in the vicinity of Summit Lake. He thought that the later reduction observed in their numbers was due to winter trapping in that neighborhood.

The female, a young one caught at Warner Creek, weighed 835 grams; the male, an adult, 1232. The stomach of the female contained parts of a golden-mantled ground squirrel (*Callospermophilus*) weighing 38 grams. The male had eaten only the bait that was used at the trap—flesh and feathers of a bird. These animals were both caught in the one setting of traps, on September 21 and 28, 1923. At that time both skins were unprime all over. The male had an abdominal skin gland measuring one by three inches. A smaller gland on the female measured one-half by three inches (Dixon, MS). (For description and for discussion of probable purpose of these glands, see Hall, 1926, p. 227.)

Martes pennanti pacifica (Rhoads)

Pacific Fisher

We were told that a fisher had been taken by a trapper at Eagle Lake in 1920. The pelt sold for sixty-five dollars. People who live in the section say that fishers are sometimes trapped in the "lake country" to the west of Eagle Lake.

Mustela muricus (Bangs)

Sierra Least Weasel

A male of this species was caught, July 2, 1924, in a rat trap that was set beneath alders bordering a stream on a steep rocky mountain side two miles west of Black Butte, 6800 feet. The animal weighed 54.5 grams.

Mustela arizonensis (Mearns)

Mountain Weasel

Three weasels were trapped at Kelly's, 5200 feet, July 29 and 30, 1924. Skins from three miles west of Eagle Lake, 5800 feet, and four miles south of Eagle Lake, 6000 feet, were obtained from a trapper. Two males weighed, in grams, 242 and 260. The weasels at Kelly's were trapped at the entrances of marmot burrows on rocky slopes.

Tracks of a weasel were found in the snow close to Mineral, 4900 feet, December 19, 1927. Trappers in that locality say that there are many weasels in that vicinity. The westernmost locality of reported occurrence in the section is Lyman's, 3300 feet.

Two miles west of Red Rock P. O., at 7 a.m., on July 21, 1928, a weasel was seen among sage-brush on loose sand. The animal was digging in the sand with its fore feet. Several small birds were flying from bush to bush near by and chirping nervously. A few minutes later this weasel was seen running over the sand, crossing a small clearing.

The identity of the weasels occurring in the "Great Basin" portion of our section is in doubt, specimens lacking. Curiously, we found no evidence of existence of weasels in the Sacramento Valley.

Mustela vison energumenos (Bangs)

Pacific Mink

Mink were present in small numbers at Eagle Lake, along the Sacramento River, and on Battle and Paine's creeks. Specimens represent the following localities: Silva's, 250 feet; Dale's, 600 feet; Spalding's, 5200 feet.

On April 12, 1928, a wood duck was flushed from the edge of a slough at Silva's near the Sacramento River. At the same time and seemingly from the same place at the edge of the water a mink ran up the bank and toward the observer. Then, apparently confused for some reason, the animal turned and started away, running parallel with the stream. Within a few seconds it appeared again, this time running directly toward the observer. Not until the animal was shot did it attempt to seek cover; then it turned and dragged itself under the edge of a pile of drift where it died. From its behavior when disturbed it was thought that this animal must surely be unfamiliar with the locality and the nearest available hiding places. High water that had covered the ground two weeks previously may have changed the arrangement of the many nearby accumulations of drift so as to confuse the animal. Also, it is possible that this particular individual had not previously visited that locality. Some such explanation of the delay in getting to a hiding place seems to be demanded in this instance (Linsdale, MS).

A mink den was seen on June 13, 1929, among rocks on an island in Eagle Lake. The place was merely a slightly protected retreat marked by an accumulation of refuse food material and a great lot of excreta. These latter appeared to be made up largely of feathers. At another place a fish had been dragged up beneath some rocks, probably by a mink. Mr. S. A. Webb trapped on this island during the previous winter and caught several mink. He said that the animals moved freely back and forth between the island and the mainland. The intervening channel was a narrow one.

Lutra canadensis brevipilosus Grinnell

California River Otter

Nearly all the people in the western part of the section that were questioned concerning this species knew of its occurrence in the region, but most of the accounts were indefinite. Individuals were reported to us in 1927 as having been caught in the Sacramento River within the previous few years. One was believed to be present in or above Iron Cañon in January, 1928.

Mr. Harry Brittan of Red Bluff told us that at one time, in the winter of 1928–29, he saw three otters in the flesh that had been trapped in the Sacramento River just below the Bend Ferry.

Mr. Ted Wells of Mineral said that he caught an otter in Battle Creek Meadows in 1926, but he considered the species to be rare in that vicinity. Mr. Mike Kelly told us that in the first part of July, 1924, he had seen three otters together at a pool in King's Creek close to 5000 feet altitude. One of the animals was upstream and two at the lower edge of the pool. The animals slowly moved toward one another; then two of them dived and each secured a trout.

The men in charge of the State fish hatchery on the North Fork of the Feather River reported on June 19, 1928, that otters were then active almost every night in the stream close by.

Spilogale gracilis saxatilis Merriam

Great Basin Spotted Skunk

In June, 1929, we obtained a skull of an individual that had been trapped during the previous winter by Mr. Cyril E. Eneboe. The animal was caught in the hills at the edge of Madeline Plains thirteen miles northeast of Ravendale. Several persons in and near Ravendale told us of having seen or trapped this species regularly but in small numbers in the hilly country in that vicinity.

Spilogale phenax phenax Merriam

California Spotted Skunk

Two males were preserved as specimens from Dale's, 600 feet, December 29 and 30, 1924. One was trapped beneath a log near a rock ledge along a creek. The other was on a rocky slope that was covered with buck-brush. Weights, in grams, of these two animals were 442 and 680, respectively.

In 1883–84, Townsend (1887, pp. 185–186) found this mustelid "rather common in the timber belts around Red Bluff. . . . ." Specimens were preserved under dates of March 28 and April 8.

Mephitis occidentalis occidentalis Baird

Northern California Striped Skunk

Specimens representing this race were obtained at Red Bluff, 300 feet; Dale's, 600 feet; Mineral, 4900 feet (fig. 107). An adult male trapped in June weighed 1663 grams. Two adult females trapped in May weighed 1259 and 1667 grams.

The specimen from Red Bluff was trapped near a clump of willows at the edge of the water. At Dale's, occurrences were recorded in a vegetable garden, in a potato field, and near a creek.

A No. 1 steel trap baited with bird bodies and set on a log at Mineral, May 12, 1927, caught and held a full-grown skunk. This animal was released by pressing down the spring of the trap with a long scantling. The skunk, as is usual with this species, hardly seemed to notice its release and ambled off slowly through the young cedars and among some rotting logs. No odor had been, or was, given off by this animal.

One skunk at Dale's formed a habit of going the rounds of a line of mousetraps and taking the dead mice. When captured its stomach was found to be filled with mice.

At 4 p.m. on June 3, 1924, a young skunk was come upon walking at the edge of the creek at Dale's. When approached, the animal waded into the stream and started to swim across. It was captured but escaped during the night. On the next evening it was recaptured and was then kept for a week, when it became entangled in a rope and died. This youngster appeared at first not to know how to eat, although seemingly hungry. When food was placed in its mouth it would chew and finally swallow it. When a person walked toward this individual it would move away by hopping backward with its hind feet and dragging its front feet. Then it would pause and strike the ground with both front feet. A proffered piece of meat was taken with a quick snap. When disturbed by human presence the young skunk showed displeasure by carrying its tail in a vertical position, but when feeding undisturbed the tail was dropped so that the tip touched the ground. When permitted to move about the camp the skunk showed curiosity and investigated various items of the equipment. When it died on June 10 it weighed 207 grams. This animal was thought to be one of a litter belonging to a female that had been trapped previously close to the place of its capture (Borell, MS).

Mephitis occidentalis major (Howell)

Great Basin Striped Skunk

A single specimen referable to this subspecies was obtained in the section: female, trapped at Spalding's, 5200 feet, on Eagle Lake, October 22, 1923; weight 4 pounds. The trap holding this animal had been set at the entrance to a caved-in muskrat den at the edge of the water. The skunk's stomach contained portions of a coot, possibly one that had been found dead in the drift along the shore. The pelt was nearly completely prime (Dixon, MS).

A large skunk was found dead in a field east of Madeline on September 23, 1924. A trapper near Dransfield's caught a skunk in early October, 1924, in a trap that was placed at the carcass of a cow.

Taxidea taxus neglecta Mearns

California Badger

A small female, weight 8.5 pounds, was captured alive on Warner Creek at 6600 feet, September 19, 1923. The skull of a badger is in the Museum of Vertebrate Zoology from the neighborhood of Termo. In the vicinity of Warner Creek a badger was noted September 10, 1923, in a valley at 7500 feet where pocket gophers were abundant. Another come upon in the afternoon of September 19, walking, when pursued took refuge under a large rock.

On the evening of June 27, 1929, Mr. B. F. Loomis of Viola, in driving over a portion of the Scenic Highway through the devastated area within the Lassen Volcanic National Park, saw three badgers. These animals were out before dark and, presumably, foraging.

In the eastern part of the section the Oregon ground squirrels habitually dig burrows in wheel tracks in the roads. Badgers that dig out the squirrels in such locations leave large holes which constitute a source of annoyance, even of danger, to persons who drive automobiles over the roads (Dixon, MS).

At the collecting station five miles north of Fredonyer Peak and at Dransfield's, much evidence of badger activity was seen. Badgers were also found present, in 1911, at Cone's and Sisson's, four miles east and south, respectively, of Red Bluff. On March 15, 1884, C. H. Townsend (1887, p. 187) obtained a young one near Red Bluff, only "7 or 8 inches in length."

Two freshly dug holes with dirt thrown out the previous night were found, April 9, 1928, at ground squirrel mounds on the prairie ten miles north of Red Bluff. On top of the dirt by one hole was a piece of the tail of a ground squirrel. Badger tracks showed plainly in the freshly thrown-out earth. Since the two holes were only a quarter of a mile apart, this seemed sure evidence that a badger had hunted over that portion of the prairie on the night before.

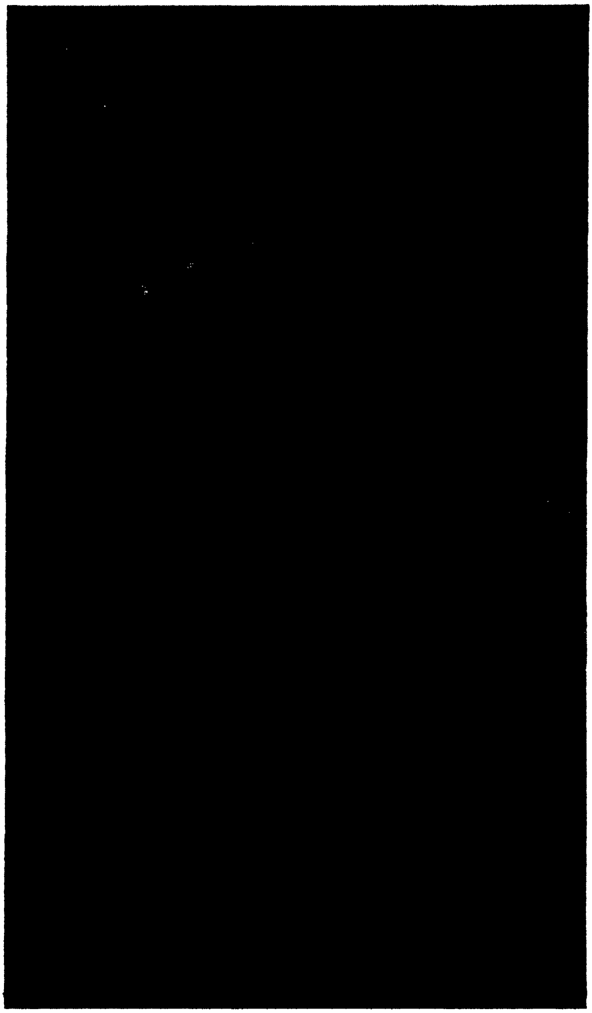


Fig. 150. Holes made by a badger (*Taxidea taxus neglecta*) in excavating Oregon ground squirrels (*Citellus oregonus*). These rodents form an important source of food for badgers in the eastern part of the section. Photograph taken June 1, 1925, near southern end of Eagle Lake. Mus. Vert. Zool. no. 4665.

Badgers were reported to occur frequently in the vicinity of Red Rock P. O., and the presence of many individuals of this species was verified by the finding of many large holes in that neighborhood. Apparently, these animals preferred to live in the hay meadows, for more holes were seen there than at other places. (See fig. 150.)

At 7:30 p.m., July 23, 1928, a young badger one-third grown was seen walking on loose sand among sage-brush and other bushes, two miles west of Red Rock P. O. At first the animal tried to escape, but when pursued it stopped, backed toward a bush and faced its pursuer. When the observer stepped a short distance away the badger again started running. By breathing heavily through the nostrils and curling the nose upward when exhaling, the young badger kept up a nearly continuous noise, while it was cornered. At the same time it scratched in the sand with both front and hind feet. The whole appearance was that of a thoroughly frightened young animal instinctively resorting to this ''dangerous'' attitude on the chance of securing safety thereby (Linsdale, MS).

Vulpes fulva necator Merriam

Sierra Nevada Red Fox

The single specimen in our collection from the section is a skin obtained by a trapper at 6100 feet altitude five miles southeast of Eagle Lake. Tracks thought by us to be of this species were seen at the following places: Broke-off Mountain at 8000 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet.

According to Mr. Ted Wells, who has trapped for fur seven winters, with headquarters on Battle Creek Meadows, the red fox has, certainly, occurred west along the south side of Battle Creek Cañon to Cold Creek Butte which is some three miles west of Mineral. From one to six have been caught by him in the neighborhood each year, an average, perhaps, of ''3 or 4.'' The general population of foxes, Mr. Wells thinks, is small, as it always has been, and is kept so by the winter scarcity of the food upon which the foxes depend, namely, snowshoe rabbits, chickarees, mice, and grouse. The foxes go in pairs all winter, but ''mating'' takes place in February.

A line of traps on one of the ridges near Eagle Lake maintained by two trappers in the winter of 1924–25 produced ten red foxes. This marks the eastern limit of known occurrence for this species in our section. Apparently it is here rather strictly a Boreal animal.

On September 23, 1923, a red fox was found regularly foraging about a rock slide at 6600 feet altitude on Warner Creek, as judged by its tracks in the snow. This slide was inhabited by many conies and bushy-tailed wood rats (Dixon, MS).

There is a published record of red fox from "Red Bluff, California" under the name *Vulpes fulvus argentatus* (Townsend, 1887, p. 188). It is stated by the author that "I [he] secured a half-grown Black Fox at Red Bluff, in 1884, by digging it out of a hole." According to the accompanying table the specimen was a "skin" taken "Mar. —," 1884, and constituted the collector's number 208, and no. 14428 in the National Museum collection of mammals. The present senior author, while in Washington, D. C., in November, 1924, made an effort to locate this specimen. According to the National Museum register it was found to have been no. 14423, and had been preserved as an alcoholic. No trace of it could then be found, and there was a good chance that it had long ago been discarded.

Still more recently, Dr. Chas. H. Townsend, the collector of this "Red Bluff" specimen of red fox (which was evidently in the black phase of pelage) sent us his original field catalogue. In this, in the list of mammals collected at "East base of Mt. Lassen, Lassen Co., Cala." in 1884 appears this entry: "208 Vulpes argentatus (black) juv July." Furthermore, the preceding number, 207, pertains to "Tamias lateralis" [=*Callospermophilus chrysodeirus*], a species which is of Boreal distribution, and never could have been taken "at" Red Bluff. In the published report (p. 170) this skin of *Callospermophilus* is given in the table of specimens collected as having been taken on July 5 in "Lassen County, California."

The published entry for this red fox was thus, now with no doubt whatsoever, at fault in several respects, notably as to exact locality and date; the fox was captured really somewhere near the east base of Lassen Peak and so, well within the normal zonal range of the species; and it was taken in July (rather than March), the proper season for finding young in a den.

Urocyon cinereoargenteus californicus Mearns

California Gray Fox

Two gray foxes were taken by a trapper within three miles west of Dale's, 600 feet, in February, 1925, and sent to the Museum in fresh condition. The male weighed 8½ pounds, the female, 7½. In that general vicinity, and from there up and east to the neighborhood of Lyonsville (about the 3500-foot contour), informants agreed that gray foxes had been at times common; but in the years of our own work in that belt, they were rare, and this scarcity was attributed to the wholesale poisoning of that territory against coyotes. It would seem that foxes are, incidentally, very susceptible to this method of carnivore control. Mr. Ted Wells told us that in his trapping experience he knew of no capture of a gray fox east of the western edge of the "green timber," and that the range of the red fox of the high mountains and that of the gray fox do not quite meet anywhere. The latter seems to prefer the chaparral belt of the Upper Sonoran lifezone. Dens were reported as having been found in broken-lava rimrock.

Canis lestes Merriam

Mountain Coyote

[*Canis ochropus* Eschscholtz
California Valley Coyote]

Twenty-two skulls of coyotes from the section represent the following places: Dale's, 600 feet; vicinity of Lyonsville, 3300 feet; Mineral, 4900 feet; two miles west of Black Butte, 6800 feet (skin accompanies a skull from this place); Willow Creek Valley, 5000 feet; Horse Lake Valley, 5000 feet; Dransfield's, 5300 feet. In addition, coyotes were seen or heard at the following localities: ten miles east of Red Bluff, 500 feet; Lyman's, 3300 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; Lake Helen, 8200 feet; Warner Creek at 7500 feet; Wilson Lake, 5100 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; Petes Valley, 4500 feet; Box Springs, 5300 feet.

Townsend (1887, p. 188) speaks of the coyote as constantly harassing "the sheep that are herded there [in western Lassen County] in thousands in summer." Even then, 1884, it was considered "rare in the Sacramento Valley."

On April 14, 1928, a coyote was seen to cross the road in front of an automobile ten miles east of Red Bluff. The animal moved off slowly across the boulder-strewn plain, occasionally jumping to the top of a boulder and looking around in all directions. The boulders covered the ground so thickly that this behavior was necessary for this animal to see any distance around it.

In the cañon at the upper end of Petes Valley, on June 8, 1929, two coyotes were seen together to start across the marsh. When the animals saw a person standing near by, one of them rushed on across the shallow water while the other turned back to get out of sight on the rocky cañon wall.

On June 13, 1929, an observer (Linsdale) walking through the stub-forest near Spalding's noticed a coyote moving over the fairly open ground. As the course of the animal was taking it away from the observer, a few "squeaks" were produced with the hope of attracting its attention. Immediately the coyote turned and started directly toward the source of the sounds. It came to within thirty-five steps of the person standing in the open and then it stopped after seeing what it was stalking. After a short pause the animal turned and started off slowly. When it had gone 150 meters, more squeaks caused a halt for several minutes but it finally went on off. A great many times the coyote sniffed with its nose pointed upward, evidently in an attempt to catch some scent, but apparently it got none, since the efforts were repeated over and over. As it moved off, the animal stopped repeatedly and looked backward. Two or three times it jumped to the top of a log to obtain a better view. Here was an excellent opportunity to observe behavior of a coyote when different stimuli, operating at the same time, called forth conflicting instinctive responses.

It was the opinion of Mr. Ted Wells of Mineral that there were two types of coyote in that neighborhood. A large grayish kind, he said, lived in the higher portions of the mountains, and wintered there, never coming so low as Mineral. The other type, "true coyote," he believed, came into the vicinity in the spring from the west along with the deer and cattle from the lower foothills and Sacramento Valley Nearly every individual of this type went out in the fall so that few were present in winter at that altitude.

At Wilson Lake on May 24, 1927, just at noon of a brilliantly sunshiny day, two coyotes set up a chorus of howlings sounding to the listener deeper in tone than the voice of the valley race—more "wolf-like." This performance was heard from the deep woods up on the ridge immediately to the west of the lake.

A coyote pelt was examined (Grinnell, MS) in December, 1924, that had been trapped among the digger pines two miles northeast of Inskip Hill. The pelt had long ears rather than short, blunt ones, coarse overhair and short underfur, and reddish cast of color rather than gray. These are characteristics of *ochropus* rather than of *lestes*.

Mr. Creath Dale told us that in the vicinity of his ranch on Paine's Creek coyotes in some years had killed many sheep. Also under the practice of herding turkeys out onto the plain to feed on the abundant grasshoppers, considerable risk of loss from coyotes had to be borne. Several of the birds had been killed at one time, when not closely guarded.

Constant efforts of stock-raisers in the section, along with the trapping for fur, tended by 1924 to bring the numbers of coyotes down to a minimum. This gives cause for complaint by many persons residing in the eastern portion of the section, who depended largely for their living upon income from trapping coyotes in winter. For example, a man interviewed in 1924 near Termo, Jacob Bietz, said that he was able to realize about $400 each winter on the fur he trapped, of which coyotes formed the major part. He had received for coyote pelts an average price of $9 each; for one he received $32, and in 1919 he was paid $100 for five pelts. This man declared that he relied chiefly on coyotes for his living.

In the western part of the section we heard complaint that the destruction of coyotes under government auspices was so done as to protect the large ranches and that no efforts were made either to protect the small stock farms or, where other interests permitted, to conserve the interests of the fur trapper.

Thus, the coyote proved to be, economically, from one point of view or another, one of the most important native mammals of the section.

The material from the Lassen section representing the coyotes proves inadequate for satisfactory handling of the question of their systematic status. There is but one skin, and it is a midsummer-taken one, badly worn and "scorched." The rest of the specimens are skulls-only, obtained from trappers or poisoners and most of them without record of date or sex. This material represents localities from Dransfield's, near our eastern limits, west only to Dale's. Unfortunately, we have not even one specimen from the actual floor of the Sacramento Valley, where the form *ochropus* should on geographic grounds be the characteristic one.

The majority of the skulls in our series, from places west clear to Dale's, show in fair though varying measures the features of *lestes* as represented by comparable material from places in northern Nevada. But from several localities, from Horse Lake west to Dale's, are also skulls showing more the features ascribed to *ochropus* and which we see in specimens from the San Joaquin Valley. Numbers 24618 from Horse Lake Valley, 24613 from Willow Creek Valley, 34755 from two miles west of Black Butte, 34754 from Mineral, and 34318 from Lyonsville are notably *ochropus*-like. The features we have used in this (artificial) discrimination are as follows ("*ochropus*" type compared with "*lestes*"): smaller general size, slenderer rostrum, relatively smaller teeth, premolars more widely spaced, and zygomatic arch outspreading in a less regularly curving arc.

The meaning of this wide cranial variation in the Lassen series of skulls, including as it does, extremes identifiable superficially as *lestes* or as *ochropus,* is not clear to us, because of the existing lack of correlation of locality with trend of cranial characters.

Theoretically, it might be said that there are two full species, *lestes* in the Great Basin and *ochropus* in the Sacramento Valley, individuals of each species invading common interlying territory, all the way from Horse Lake Valley to Dale's. A supporting idea is that, as some of our informants believe, there is an eastward "migration" of west-end animals in spring and that these go nearly or quite across the mountains, occurring then on common ground with the resident "gray wolves" (local name for *lestes*) though not consorting with them.

This theory would have better status if we had skins with the skulls, so as to check up the characters of the two forms throughout, including not only external ones of color but of quality of pelage and size of ear. Also, we know definitely the date of capture of only one of the eastward "*ochropus*," no. 34755, captured by our party near Black Butte, July 1, 1924, though this is corroborative so far as it goes. Another objection is that we are now doubtful as to the true significance of the above designated features of discrimination. All the extreme "*ochropus*" skulls, where the sex is definitely recorded, are females, and also they are immature, that is, not more, we think, than one year old. Therefore we are not sure but what age as well as sex and, perhaps, ordinary individual variation, has come into play to produce the skull characters here in question.

An alternative theory is suggested, namely, that through this territory the race of the Great Basin and that of the Californian faunal area intergrade, not "smoothly" as in the case of *Peromyscus maniculatus,* but mosaically as in the case of *Psaltriparus minimus* (see p. 317), with some of the resulting individuals more in the nature of "hybrids." But, again, we feel that our evidence is too poor to warrant any proposal of systematic rearrangement that this alternative theory would imply.

Felis oregonensis californica May

California Mountain Lion

Close to Kelly's, in the last week of September, 1923, a mountain lion was seen and shot by a ranch hand. This constitutes our most definite record of this animal in the section. Most of the persons who had lived long in the middle altitudes of the section knew of lions as occurring in their neighborhoods. Reports from such sources pertained to the following localities: Lyman's, 3300 feet; Cold Creek, 4000 feet, west of Battle Creek Meadows; Mineral, 4900 feet; vicinity of Eagle Lake, 5200 feet.

Lynx rufus californicus Mearns

California Wildcat

A female, trapped at Dale's, 600 feet, January 12, 1925, furnishes the only available definite record of the occurrence of this subspecies within the section. With scarcely any doubt, the wildcats of the entire western portion of our section, at least from Mineral westward, belong to this same race. Tracks observed by us, or reports from trappers and ranchers, showed that wildcats were present toward the mouth of Mill Creek (near Tehama), on Paine's Creek (near Dale's), and in the vicinity of Lyonsville. On Battle Creek Meadows, around Mineral, wildcats have been trapped for fur in winter time. One of us saw there, on December 19, tracks of a bobcat in the snow among willow thickets where footprints of snowshoe rabbits were thickest.

Mr. Creath Dale informed us that, in lambing season, wildcats, even though far fewer than coyotes, do more damage than the coyotes, in killing and carrying off the young lambs. Mr. Dale, on his ranch on Paine's Creek, has at times lost also chickens and turkeys to bobcats.

Lynx rufus pallescens Merriam

Pallid Wildcat

A skin from the east side of Eagle Lake and a skull from near Horse Lake attest the presence of this race of wildcat in the eastern part of the section. Trappers reported catching small numbers some winters in the vicinity of McDonald Peak and around Eagle Lake. One trapper caught two in the latter locality in the winter of 1924–25. Wildcats were reported also as occurring around Drakesbad, but the subspecific characters of the population in this interlying portion of the mountains are in doubt—whether falling with *pallescens* or *californicus*. (See Grinnell and Dixon, 1924.)

Marmota flaviventer flaviventer (Audubon and Bachman)

Yellow-bellied Marmot

Specimens were obtained at the following localities: southwest of Black Butte at 6600 feet; Hat Creek at 8000 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Gallatin's, 5200 feet; Petes Valley, 4500 feet. Also observed at Drakesbad, 5500 feet. A marmot was seen in the broken edges of a lava cap at Horse Lake on May 19, 1918. Evidencces of the presence of this species were noted near Termo in 1924.

An adult male collected June 17, weighed 1800 grams (4 pounds). One collected September 17, weighed 5 pounds. An adult female killed on July 30, weighed 4⅜ pounds.

A female that was obtained, May 11, 1929, on the Red Bluff-Susanville highway, near Wilson Lake, weighed 4 pounds. Contained in this female were seven embryos averaging eighteen millimeters in length.

Nearly all the marmots seen in the section were in the edges of broken-up sheets of lava or among large rocks in slides. One burrow was found beneath a large boulder on a brush-covered hillside.

Just before midnight of July 30, 1924, a large marmot was observed in front of an automobile, crossing a road east of Mineral. When pursued the animal took refuge beneath a wagon in a barnyard (Hunt and Borell, MSS). This observation indicates that woodchucks may occasionally wander about at night.

The latest date on which a marmot was observed in the fall was September 16, 1923, when one was obtained near the head of Hat Creek at 8000 feet altitude. An examination of many deposits of feces in that locality led to the opinion that most of the individuals of this species started hibernation by the first of September (Dixon, MS).

Near Gallatin's on June 1, 1925, a family of eight small young accompanied by an adult was seen among rocks. One of these young animals, a female, that was shot weighed three-eighths of a pound. A short distance away another family group of four young was seen. A male that was collected from this group weighed half a pound.

At the border of a ridge of lava at the east end of Butte Lake on June 17, 1926, an adult male was collected and another adult, probably its mate, was seen along with two young ones. A young male that was collected weighed 490 grams (one pound).

Two families of young marmots were seen at Drakesbad on June 23, 1925.

It is noteworthy that in Petes Valley, marmots were fairly common in association with Upper Sonoran plants and other mammals. Here the presence of retreats among large blocks of stone figured more importantly, apparently, than the supposed factor of summer temperature.

Otospermophilus douglasii (Richardson)

Douglas Ground Squirrel

Generally distributed in the western part of the section up to the 3200-foot contour line, and of scattering occurrence as far eastward as Mineral, 4900 feet. Specimens represent the following localities: Red Bluff, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Lyman's, 3300 feet. Observed also at the following additional localities: ten miles north of Red Bluff, 500 feet; Blue Tent Creek, 350 feet; Cone's, 270 feet; Bloody Island, 350 feet; west bank of Sacramento River between Red Bluff and Tehama; Tuscan Springs, 1200 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Mineral, 4900 feet.

Five males trapped in May at Red Bluff and Dale's weighed from 595 to 741 (average 660.4) grams. Three males obtained at Lyman's, June 10, weighed 463, 495, and 614 grams. Weights of three females from Red Bluff and Dale's in May averaged 525 (502 to 542) grams.

On December 19, 1927, three ground squirrels were seen, above ground and active, on south-facing slopes near the Lassen Peak Highway and just below the 3000-foot contour line. All our other records for this species in the section date during the summer. The great bulk of the population evidently hibernates.

Townsend (1887, p. 172), in an account of his experiences with this species in the neighborhood of Red Bluff in 1883–84, expresses his belief that its hibernation there is incomplete. He says: "I was not in the [Sacramento] valley during January and February, but in December and March the only indications of hibernation were its decreased numbers."

A further comment of Townsend's, made over forty years ago, is corroborative of conditions today. "Douglass's Spermophile is a destructive animal to growing crops, and although under the ban of agriculturists seems to maintain its existence in spite of all poisons that may be employed against it."

In the western part of the section this ground squirrel lived in such situations as the following: in the more open portions of the blue-oak covered hills; around the borders of fields; in waste ground bordering streams; at roadsides; on rolling, open prairie land; in broken rock outcrops. Some individuals found home sites in and beneath rock fences.

At the western end of Battle Creek Meadows, one of the highest and easternmost stations of occurrence, Douglas ground squirrels were found inhabiting the same tracts of broken lava (fig. 78) in which conies were numerous.

Entrances to burrows were usually on steeply sloping ground or close to the brink of some low bank. Possibly such sites afforded better drainage than the more level ground and thus helped to save the inhabitants from drowning at times of heavy rains. Many of the openings were beneath boulders, old stumps, trunks of large living trees, or some other type of obstruction on the ground. These obstructions may have served for protection in deterring enemies from digging out the squirrels.

About ten ground squirrels were seen on April 5, 1928, in the blue-oak covered hills six miles north of Red Bluff. The day was an especially warm one for that time of year. Several individuals, judged to be young of the previous year, were watched for more than an hour in the early afternoon. First, one squirrel climbed a tree and stayed nearly fifteen minutes on a short, broken limb. Two others, meanwhile, chased oneanother back and forth with short, quick rushes and long pauses, until one left. Next, the one in the tree came down and ran slowly but directly to an old, partly filled hole in a vertical bank one-third of a meter high. Then it started digging, using the front feet only. At intervals of a few seconds the animal backed out of the hole and climbed to the top of the bank to look about. The digging was continued until the animal was entirely out of sight. When the squirrel came out after each period of digging it emerged tail first.

Later, these two squirrels, foraging over the ground, came to within three meters of the observer. It was clearly seen that they were cutting the green fruiting stalks of alfilaria, holding the stalks in the forefeet and eating the green seeds, then discarding the rest. The second individual went to a hole and dug dirt from it; this hole went down into level ground. This individual, too, dug with the front feet only, and it came out frequently to look around. Once it went to, and sniffed at, the other squirrel which then ran off. A green-backed goldfinch called and immediately the squirrel looked around. A second sharp call sent it hurriedly with its just-cut stem of alfilaria toward a burrow. The squirrels appeared to pay no attention to automobiles passing in the road only twenty meters away.

On April 8 many more squirrels were observed in that locality than had been seen on the 5th. When disturbed, an animal would seek the nearest path through the vegetation where it might run with more ease. It seems evident that the formation of the paths results from choice of certain easily traversed routes (Linsdale, MS).

One individual that climbed to the top of a fence post used the cross wires of the fence rather than the wooden post. When this animal left the perch it jumped to the ground.

Ground squirrels were seen often on the limbs of trees. One was on a dead limb in the top of a tree and at least twenty meters from the ground. It was noted that when the squirrels climbed trees they kept within a shorter radius of their burrows than when they foraged on the surface of the ground.

One instance was noted of the destruction of these squirrels by natural enemies. On April 9, 1928, on the prairie ten miles north of Red Bluff, two squirrel homes were seen that had been dug out the previous night, and tracks in the fresh dirt indicated that a badger had dug them out. A part of a squirrel's skin on one of the mounds showed that the badger's hunt had been successful.

Many persons who farmed in the western part of the section depended upon poisoning to reduce the numbers of this pest in fields. Even though it was necessary to repeat the poisoning for this kind of regulation to be effective, our observations indicated that the reduction in numbers of the squirrel was sufficient to repay for the effort of repeated poisoning.

Travel by automobiles over the roads in the section provided a constant source of danger to those ground squirrels that lived in roadside terrain and which in their foraging exposed themselves to the possibility of being run down. One individual was seen, April 22, 1928, that had just been run over and crippled in a road near Dale's. Another individual nearby showed evidence of concern, continually running to and from the injured one. It was thought that possibly this was a mated pair.

Young, half-grown, actively abroad, were seen near Dale's on June 3 (1924). A suckling female was observed near Mineral, June 24 (1925). Variation of breeding time with altitude is indicated.

Callospermophilus chrysodeirus chrysodeirus (Merriam)

Sierra Golden-mantled Ground Squirrel

Recorded throughout the mountainous portion of the section from vicinity of Battle Creek Meadows eastward as far as the limit of the section. Specimens collected at the following localities: Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Lassen Peak at 9500 feet; Warner Creek at 8300 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Spalding's, 5200 feet; Horse Lake, 5000 feet. Also observed at the following additional localities: western end of Battle Creek Meadows, 4800 feet; Mineral, 4900 feet; Kelly's, 5200 feet; Prospect Peak, 8300 feet; Butte Lake, 6100 feet; Eagle Lake Resort 5200 feet; eight miles southwest of Ravendale, 5600 feet; four miles northeast of Red Rock P. O., 5400 feet.

Thirteen males collected in late September and early October between 5500 and 8300 feet in Warner Creek Valley weighed from 131 to 220 (average 176.8) grams. Nineteen females from the same places at the same time weighed between 126.5 and 265 (average 172.9) grams. A female from 9500 feet on Lassen Peak taken in September, weighed 225 grams. Three males from Spalding's in October weighed 181.1, 184.5, and 192.5 grams. A male from Manzanita Lake in June weighed 152.7. Females collected at Summit Creek in June weighed 202 and 213.5 grams.

On the southern base of Lassen Peak it was observed that this squirrel showed a preference for rocky or log-strewn open slopes that were adjacent to meadow edges, ravine bottoms, or chaparral patches. The squirrels avoided meadows, solid chaparral, and thick woods. Although none was seen to climb the vertical trunk of a tree, individuals would often climb to the tops of stumps or to the summits of boulders or rock heaps, there to sit for many minutes at a time. Usually the sun was shining on the animal, which at least was not thereby inconvenienced.

In the vicinity of Manzanita Lake many individuals were seen on rocks, on logs, and at openings of burrows on level ground. It seemed that at that place this species used deserted burrows of pocket gophers for homes. Several were seen among the rocks north of Butte Lake but none was noted on the flow of lava that extended to the lake from the west.

On July 27, 1929, this ground squirrel was notably abundant along the highway through the devastated area northeast of Lassen Peak. (See figs. 5*b* and 40.)

Nine golden-mantled ground squirrels were collected during the first week of October, 1923, from a ten-acre, south-facing, yellow pine bench. The animals appeared to have been attracted to the place by food and refuse thrown out by campers. Apparently, this species is not closely dependent upon any particular type of vegetational cover. It was found sometimes in stands of red fir, sometimes in hemlock, in addition to the kinds of surroundings mentioned above, and it was even found on the rocky peaks above the timber, as on the summits of Broke-off Mountain and Lassen Peak where a guide from Drakesbad reported its frequent occurrence.

Despite their bright pattern of colors the squirrels, when posed motionless, easily escape the human eye. When running they become instantly extremely conspicuous, the irregular zigzag course, up-and-down movements of the body, and fore-and-aft swing of the tail, together with the strikingly contrasted coarse side-stripes, catching and holding the eye of the observer. But the whole thing vanishes when the animal stops, again rigid, or, if really alarmed, goes around a log or among stones. One that was watched for several minutes as it explored some ground would scuttle quickly across bare open spaces, and do its loitering and hunting when near to rocks or other cover. (See figs. 151 and 152.)

Fig. 151. An adult Sierra golden-mantled ground squirrel (*Callospermophilus chrysodeirus chrysodeirus*) at edge of snow-brush thicket; shows position of body assumed when eating on the ground, and also place chosen for eating, whence a quick dash will give protective shelter. Photograph taken October 2, 1923, at Drakesbad. Mus. Vert. Zool. no. 4204.

One of this species of ground squirrel that was watched on the morning of July 17, 1928, eight miles southwest of Ravendale, kept for most of the time a "picket-pin" position on the top of the highest rock in an outcrop. While it stood upright it turned its head to look in different directions. Twice it ran down over two or three boulders, to return presently to the highest one and resume the vertical position. Once, for a few seconds, it sat in a "humped" position.

One instance was observed in which a "callo" pounced upon a chipmunk that was carrying a cracker and took away the food. However, the callo quickly abandoned the cracker when a chickaree made a rush toward it.

In early September, 1925, at Kelly's, chinquapin burrs (fig. 37) were being cut off the bushes and carried away by these squirrels.

Fig. 152. A Sierra golden-mantled ground squirrel (*Callospermophilus chrysodeirus chrysodeirus*) hesitating momentarily on its way to the shelter of a snow-brush thicket. Shows usual running position of body and tail. Photograph taken October 2, 1923, at Drakesbad. Mus. Vert. Zool. no. 4202.

It was noted near Drakesbad in September, 1923, that individuals of this species did not become active each morning until after the sunshine became hot, about 8 a.m. Near Warner Creek at 6600 feet, during an early snow storm on September 27, 1923, callos showed a tendency to remain in their holes, but after the storm they came out, leaving small round holes through the snow, and ran about conspicuously over the snow-covered ground. Two females trapped September 21, 1923, were extremely fat. From one, 29.5 grams of fatty tissue were cut from the skin; from the other 37.5.

April 19, 1929, was a day of showers and flurries of snow in the vicinity of Battle Creek Meadows. However, more than six golden-mantled ground squirrels were seen running over the ground and over logs and rocks at the lower end of the meadow. This was seasonally the earliest date of observed activity. A specimen collected near Spalding's, October 24, 1923, represents, for the section, the latest date of capture in the fall as well as the latest record of activity before hibernation.

In the afternoon of July 19, 1924, a squirrel near Willow Lake was observed to gather and carry off material apparently for nest-building. Of the material available, the animal seemed to prefer pieces of newspaper which it pushed into its cheek pouches with the front feet. Some dried grass was also carried away.

No female containing embryos was obtained, but the trapping of a young female, weight 63 grams, July 6, 1924, two miles west of Black Butte, indicates that in that locality the young are born in June. An adult female taken at Summit Creek June 19, 1924, was suckling young.

Citellus oregonus (Merriam)

Oregon Ground Squirrel

Found at localities east from Wilson Lake to the eastern end of the section (fig. 88). Collected at the following stations: Wilson Lake, 5100 feet; North Fork of Feather River, 5000 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Horse Lake, 5000 feet; Termo, 5300 feet. Also observed at the following localities: Lower Kings Creek Meadow, 7100 feet; Summit Lake, 6700 feet; Drakesbad, 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; Petes Valley, 4500 feet; Box Springs, 5300 feet. A specimen taken within one-half mile west of Wilson Lake in Tehama County provides the westernmost record-station known to us for this species.

Two females collected in June at Butte Lake weighed 260 grams. Three females from Wilson Lake, taken in late July, weighed 212, 223, and 230 grams. A male from that place weighed 250 grams.

This ground squirrel was found in the section in colonies which inhabited burrows at the margins of meadows and in clearings near lakes. The site occupied by each colony was on ground that was free from obstructions and where the presence of water at least subterraneously led to a growth of relatively succulent vegetation. People who lived near Drakesbad reported that the number of individuals of this squirrel was diminished during the summer of 1925, an exceptionally dry one.

Near Butte Lake where one colony was observed, individuals were seen several times among the broken blocks of lava in the edge of the flow of lava that joined the flat on which the squirrels lived, but no squirrel was seen to climb to the top of a rock. Some occupied burrows were seen which opened beneath the small bushes, but usually the entrances were on open ground where there was no protection, and also where there was no near-by obstruction to the view of the individual squirrel when in picket-pin pose at the mouth of its burrow.

At Spalding's, in June, 1928, the broad strip of shore, left within three or four years by the receding waters of Eagle Lake, was inhabited by extraordinary numbers of Oregon ground squirrels. Where dried remains of root-stalks of tules were still to be seen, an abundant low growth of grasses and herbs, with nearly bare spots of fine sediment here and there, seemed to provide ideal conditions for these rodents. Families of small young, one-third grown or less, were out in force on June 18. An attempt at raising vegetables in a garden patch at the edge of the pines here was a total failure because of the raids upon the seedlings by the squirrels from the lake side. Here we have an instance showing the ready potentiality enabling a rodent quickly to invade and occupy any favorable territory which suddenly offers. In this case the primary cause is physiographic.

In at least one instance an individual of this species and a golden-mantled ground squirrel were found to resort to the same burrow. Near Willow Lake in late July, a *Callospermophilus* was trapped at the entrance of a burrow and on the following day two Oregon ground squirrels were trapped at the same burrow. It seems likely that in this instance the burrow was the home of the *Citellus* family and that the *Callospermophilus* was an interloper whose home was somewhere else.

At several places within the section there was noted a tendency on the part of individuals of this species to place the openings of their burrows in the wheel tracks of roads. An instance which showed a possible danger in this type of situation was observed near Eagle Lake. During a rain in late May, water in considerable amount ran down a wheel track into one burrow that had been occupied by a squirrel. Since the animal was not seen after the rain it was thought that it had been drowned.

Observations in Petes Valley from July 11 to 16, 1928, revealed the open burrows of some sort of ground squirrel in the sparsely grassed areas free from bushes, but watching and trapping failed to indicate the makers. They had evidently by those dates gone into dormancy. The next year when that vicinity was visited in early June traps were set at these same burrows. By noon of the second day Oregon ground squirrels had been caught and also individuals seen. Two that were trapped were two-thirds-grown young. A great deal of their work was to be seen in the grassy places, where little pits had been dug, evidently for root-stalks. Each pit was about 25 mm. deep, with the excavated dirt piled out loosely on one side. This "apron" of dirt usually showed a squirrel's hind footprints, where it had stood, hunched over, on its haunches, and worked with its fore-paws and teeth. In seeking out the objects of these diggings the squirrels evidently ventured as far as 40 meters, in some cases, from their burrows.

The animals at this place seemed to be much more wary and alert than did others that were observed elsewhere at the same season. All the squirrels there would hurry out of sight when approached. None was heard whistling. Many adults and young were seen at the same season at the edge of Pappoose Valley and in the meadow at the south end of Eagle Lake. Here, where large numbers were present, the animals appeared to be bolder, that is, to permit closer approach and to whistle more often than was the case at Petes Valley.

In the neighborhood of Bogard R. S., this ground squirrel was abundant everywhere on the meadow. There were several sizes of young on June 21, 1929. Many individuals were seen carrying material in their cheek pouches. Two young ones at this place were seen well up in clumps of willow where they were clinging to the slender stems.

The latest date of observation of this species above ground in summer was July 26, 1924, when one was trapped near Willow Lake. In the drier territory farther east, as at Horse Lake and in the vicinity of Red Rock P. O., all the squirrels had ''gone in'' by July 13. This indicates the very early time of going into the annual period of dormancy, on the part of this rodent.

On May 19, 1918, many young one-fourth grown were seen between Madeline and Termo. On that date a female containing eight embryos was collected on the North Fork of the Feather River. A female shot near Wilson Lake, May 24, 1927, contained six small embryos. A young male, weight 70 grams, was trapped at Butte Lake, June 18, 1926. Another which weighed 110 grams was taken at Willow Lake, July 26, 1924.

Eutamias minimus pictus (Allen)

Sage-brush Chipmunk

Occurs in the eastern portion of the section westward as far as Eagle Lake. Specimens represent the following localities: Spalding's, 5300 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet; eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet; Box Springs, 5300 feet.

Three males collected in July at Box Springs weighed 30, 32, and 37 grams. A female from there weighed 36 grams. Two October-collected males from Eagle Lake weighed 34.1 and 40 grams. A female from the same place weighed 36.5 grams. Weights of four females from Slate Creek were 29, 32, 35.1, and 36.5 grams.

This chipmunk appeared to be limited in the section to sandy ground that was covered almost solely with bushes of *Purshia* and sage-brush (fig. 44). The population at each station, where found at all, was small. For example, a whole morning's hunt near Box Springs resulted in seeing only three. The animals ran at even a slight disturbance so that it was difficult to get near enough to shoot them.

The latest record of activity in the fall is on October 22, 1923, when one was collected near Eagle Lake.

Eutamias amoenus amoenus (Allen)

Klamath Chipmunk

Collected from a point two miles west of Mineral eastward as far as near Termo. Specimens represent the following localities: near Battle Creek Meadows, two miles west of Mineral, 4800 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet, eight miles southwest of Ravendale, 5600 feet; Termo, 5300 feet.

Weights of ten largest males from the section, collected in September and October, averaged 49.7 grams. The ten largest females averaged 53.5 grams in weight. Extremes of weight of fall-collected males were 30 and 57.5 grams. Extreme weights of fall-collected females were 29 and 58.5 grams.

This species of chipmunk, in the district lying from the summit of Turner Mountain to the upper slopes of Broke-off, was seen usually on the ground within or among thickets of snow-brush or chinquapin (fig. 153). Headquarters were maintained within or beneath stumps or logs, especially where these were overgrown with the bushes, and routes of travel between such retreats distant from one another were maintained along such rotting logs or fallen branches as might intervene, rather than across open spaces. Where chaparral grew in the edges of talus slopes or over broken rock outcrops, the crevices among the rocks appeared quite as serviceable for safety refuges and dens as the logs or overgrown stumps on openly forested slopes. A characteristic type of habitat for *Eutamias amoenus* was that on Turner Mountain, 6300 feet altitude, where, on July 3, 1925, and on subsequent occasions, several individuals were conspicuously active in the Canadian-zone chaparral and rock outcrops immediately around the forest look-out house. Here and on Broke-off Mountain certain individuals had become regular companions for the observers stationed there during the summer months.

At Butte Lake, numerous individuals were seen running over the broken black lava in the edges of the flow, and some were seen and trapped about a grassy place well within the general area of lava. Exploration far and wide for sources of seeds is characteristic of *Eutamias,* so that it is a rodent quick to occupy new territory.

In the more eastern parts of our section, specimens taken were on or among rocks in or near tracts of mountain mahogany.

Fig. 153. Two Klamath chipmunks (*Eutamias amoenus amoenus*). Animal at right in typical feeding posture. Animal at left in locomotion away from observer, showing stripe pattern which has effacing effect in the eyes of a pursuer above the level of the chipmunk. Photograph taken October 2, 1923, at Drakesbad. Mus. Vert. Zool. no. 4215.

By July 25, 1925, service berries (*Amelanchier*) were turning reddish in the vicinity of Mineral. Even while these were unripe, chipmunks sought them eagerly. One chipmunk was seen to climb a slender, swaying stem, bite off a berry, balance itself on its hind feet, and manipulate the berry with its teeth and paws. Presently the animal went down the stem, head first, body fully extended.

Later in the season, ripening gooseberries (fig. 38) were eagerly sought for by chipmunks of this and other species. The pulp and seeds of the fruits were extracted without apparent hindrance from the prickles.

Eutamias speciosus frater (Allen)

Tahoe Chipmunk

Collected at the following stations: Manzanita Lake, 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Spalding's, 5200 feet.

The ten largest males collected in the section in September and October averaged 71.2 (63.1 to 83) grams. Ten largest females collected in the fall averaged 70.1 (64.6 to 88 grams).

General observations in the Lassen section confirmed the well-known tree-climbing propensity of this species (figs. 154 and 155). It is closely associated with coniferous forests, though most of its foraging is done on the forest floor or in chaparral adjacent.

Fig. 154. A Tahoe chipmunk (*Eutamias speciosus frater*) clinging to a vertical trunk of Jeffrey pine. The chipmunk's hind foot on the left side was turned backward so that it supported nearly the whole weight of the animal. Photograph taken October 2, 1923, at Drakesbad. Mus. Vert. Zool. no. 4219.

Eutamias senex (Allen)

Allen Chipmunk

Specimens collected at the following localities: north side of Turner Mountain at 5500 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8300 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Spalding's, 5200 feet; Gallatin's, 5200 feet; five miles north of Fredonyer Peak, 5700 feet.

Weights of sixteen males trapped at Drakesbad in October averaged 84.3 (70 to 105.6) grams. Weights of sixteen females collected at the same place and time averaged 85 (62.5 to 96.1) grams. Two June collected males from Summit Creek weighed 82.5 and 85.7 (average 84.1) grams. Two females from Summit Creek in June weighed 90 and 97 (average 93.5) grams.

This heavy-bodied species impresses the observer as less agile, more phlegmatic in disposition, than its smaller congeners. It is a ground-dweller, with refuges in or under logs or stumps, or in rock-piles, where these occur in or near heavy chaparral. Thickets of mixed red cherry and young firs were, in specific cases, as along the road from Summit Creek up to Soupan Springs, seem to be favorite resorts of *Eutamias senex.* Still, the two species, *senex* and *amoenus*, both chaparral-inhabiting, were in other places observed on common ground.

A female that was trapped near Gallatin's June 1, 1925, contained five embryos each 25 millimeters long and which together weighed 16 grams. Near Mineral, July 29, 1925, an adult chipmunk was seen to cross an opening and go into a large log, carrying a young one apparently one-fourth grown. The young one was carried belly up and with its tail curled over the head of the adult.

Fig. 155. Tahoe chipmunk (*Eutamias speciosus frater*) in characteristic feeding position; shows toes of hind foot widely spread, thus providing firm support for body. Photograph taken September 6, 1923, at Drakesbad. Mus. Vert. Zool. no. 4209.

Sciurus douglasii albolimbatus Allen

Sierra Nevada Chickaree

Found in the section from the 3000-foot contour line on the western slope of the mountains eastward to Eagle Lake. Specimens obtained from the following stations: Inskip Hill at 3000 feet (December 26, 1927); Antelope Creek at 3000 feet; eleven miles east of Payne Creek P. O., 3500 feet; three miles east of Mineral at 6000 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Butte Lake, 6100 feet; Spalding's, 5200 feet.

Weights of sixteen males collected in September and October in Warner Creek Valley averaged 187.8 (142.5 to 234.5) grams. Weights of thirteen females from the same place averaged 205.9 (172 to 248.2) grams. A female from Butte Lake, June 19, weighed 270 grams; one from eleven miles east of Payne Creek P. O., December 31, 219 grams.

Within the belt of coniferous trees the chickarees seemed equally at ease on the ground, on the trunks of trees, or at the tips of slender drooping twigs. Gifted with astonishing ability to run, to climb, and to cling, they were able to explore not only all parts of the forested domain—but even to venture into places beyond, out into pure chaparral or tracts of willow and alder.

In the vicinity of Butte Lake where there was a long flow of broken lava through the forest the squirrels would run from open ground to the rocks for safety, where they would go either toward the highest points or down among the lava blocks. There seemed to be more individuals at or near this lava tract than far out among the trees of the forest.

On December 19, 1927, near Mineral, four were found just where they had been in the summer preceding, and they were about as noisy then as in summer. Tracks were seen on the snow between trees, out to willow thickets, and even crossing the highway. Snow seemed to be no deterrent to the activity of this squirrel. Tracks were conspicuous whenever observations were made at times of snow within the habitat of this species. On September 27, 1923, on Warner Creek, squirrels were found to be active all during a snowstorm.

On December 20, 1927, near Mineral, red squirrels were seen perched prominently on the tips of stubs in manzanita tracts, each "rolled up into a ball," motionless until alarmed. One of these individuals kept its perch, in the shade, without moving, for over half an hour, when it was disturbed by a too close approach of the observer. It made no sound during that time.

On May 22, 1927, an observer, standing still, watched a chickaree approaching over the floor of the woods. It was closely inspecting the ground, now and then loitering, digging a little, and seeming to find something. It kept coming, zigzagging, until within ten feet, when it suddenly saw the observer and became "horror struck"; its attitude throughout indicated just that. The animal made a few stiffly jerky motions and jumped to the base of the nearest tree trunk, thereafter keeping "just around the corner" so that only one eye could be seen, and giving an irregular series of alarm cries or "barks."

A chickaree was seen to make a rush at a golden-mantled ground squirrel and frighten it away from a cracker which the latter had taken away from a chipmunk.

Chickarees were watched as they harvested cones of the Jeffrey pine at Drakesbad in early October, 1923. The squirrels began work at six in the morning and kept it up until dark, but they were especially active between eight and ten in the morning and four and six in the afternoon. Each individual usually cut from three to ten cones in a day; but one squirrel was observed to cut as many as twenty in one day. The cones averaged fifteen centimeters in length. The seeds were still green. One squirrel that was timed required ninety seconds to cut off a full-sized cone. Another one cut five cones in seventeen minutes. In one day, over fifty cones were cut by squirrels within fifty meters of one spot.

Fig. 156. A Sierra chickaree (*Sciurus douglasii albolimbatus*) dragging a pine cone toward the base of a tree; shows type of feeding perch selected on the ground, back to a tree, the animal thereby having to watch only a part of the horizon while shelling, instead of the whole of it, as would be necessary in a wholly open situation. Photograph taken October 6, 1923, at Drakesbad. Mus. Vert. Zool. no. 4194.

The cones of the Jeffrey pine were so large that it was necessary for the squirrels to cut them up on the ground. The animals regularly dragged the cones to the shelter of some thicket of snow-brush before beginning work upon them. When closely approached by a person a squirrel would leave its cone and seek safety in the nearest tree; but it would return as soon as the coast was clear.

One individual near Drakesbad that was observed on several occasions between September 5 and October 6, 1923, was busy harvesting cones of the lodgepole pine. About half the cones were eaten where they were cut. The others were carried, by the butt end, in the mouth of the squirrel, to a woodpile fifty meters away and there hidden in heaps of from eight to twenty in a pile of old red fir bark. When no person stood near, the squirrel would carry the cone over the open ground. If someone approached too near, the route would be changed

Fig. 157. Stump on which a Sierra chickaree (*Sciurus douglasii albolimbatus*) had been eating. Cores of yellow pine cones and scales cut from them have been left on the stump. Photograph taken September 7, 1923, at Drakes bad. Mus. Vert. Zool. no. 4198.

Fig. 158. Four green (unripe) Jeffrey pine cones cut from a tree in a fifteen-minute period by one Sierra chickaree (*Sciurus douglasii albolimbatus*). Also shows cores and scales of two cones that have previously been cut up. Photograph taken October 2, 1923, at Drakesbad. Mus. Vert. Zool. no. 4196.

to go through the tree tops over a well defined route [the same each trip] from limb to limb. When dissecting a cone, this squirrel would usually go up from five to six meters into a tree and take a position lengthwise on a branch, and facing outward from the trunk. The security of each perch would be tested by the animal's slamming down its hind feet several times before starting a meal (Dixon, MS). (See figs. 156 to 159.)

Fig. 159. An adult Sierra chickaree (*Sciurus douglasii albolimbatus*) on type of refuge perch characteristically used by this species. Same individual shown in figure 156. Photograph taken October 6, 1923, at Drakesbad. Mus. Vert. Zool. no. 4192.

Near Mineral in December, 1927, many places were seen where chickarees had dug down through snow and into the ground. Close by each place there would be litter of scales of lodgepole pine cones. Apparently, in those places, cones that had been buried previously were being dug out and eaten.

At Willow Lake, July 20, 1924, a chickaree was carrying nest material up into a good-sized fir tree.

On one south-facing ten-acre tract covered with yellow pines near Drakesbad, eighteen chickarees were trapped or shot during early October, 1923. The total squirrel population of the tract was estimated at close to twenty. One year later this tract was again visited and this species was found to be scarce there. Not more than one-tenth of the original number was present. Apparently, here, there had been as yet no reproduction or no invasion of red squirrels from outside territory.

Sciurus griseus griseus Ord

California Gray Squirrel

Found by us only in the western part of the section below the 3300-foot contour line; one record as high as 4400 feet. Specimens were collected at: Bloody Island, 350 feet; Dale's, 600 feet; Lyman's, 3300 feet. Also seen at Payne Creek P. O., 1600 feet, and eleven miles east of Payne Creek P. O.

An adult male from Dale's, December 31, 1924, weighed 780 grams. An adult female from Bloody Island, May 27, 1926, weighed 714.5 grams; one from Lyman's, June 12, 1924, weighed 892 grams.

Mr. Ted Wells told us that this species had at one time (several years prior to 1924) been found as far east as near Mineral, but none was ever seen by us anywhere in that vicinity during the years 1924 to 1928. On April 19, 1929, a single individual was seen a short distance above the bridge across Battle Creek and below, west of, Battle Creek Meadows.

Townsend (1887, p. 174) records five specimens of gray squirrel from Lassen County, taken by him June 1 and July 20, 1884. His manuscript notebook before us says "East base of Mt. Lassen" for the first date. These records indicate either that the species occurs locally in territory where we, forty-odd years later, have failed to find it, or that the species occasionally, in favorable periods of years "erupts" to the eastward of its normal (present) range.

Further evidence on this last point was furnished us by Mr. C. O. Fisher of Susanville, who wrote us that about the end of June, 1929, he saw a California gray squirrel near the Susan River in the neighborhood of Clover Valley, eastward from Silver Lake.

Gray squirrels within their regular range were sometimes seen singly crossing a road or running over the ground between trees. At Dale's a nest of one individual was situated eight meters above the ground in the crown foliage of a live oak. Of two squirrels that were seen near Payne Creek P.O. on December 24, 1927, one was clinging to the side of a large black oak in the creek valley and the other ran from the edge of the valley up over the bluff and climbed a large digger pine.

A gray squirrel was found living in a clump of three large mulberry trees near Manton when observations were made there in early June, 1926. On several occasions this individual was seen eating mulberries in these trees. The inner portion of each berry was discarded and dropped to the ground.

A female was obtained in a group of large yellow pines near Lyman's on June 12, 1924. The condition of its mammary glands indicated that this individual had suckling young close by.

During the period of our field work in this section the gray squirrel population seemed to be much smaller than the population the territory would normally support, as judged by the accounts of people who have lived there for several years. A slight increase in the number of individuals was noted below Lyonsville in 1927.

Glaucomys sabrinus lascivus (Bangs)

Sierra Nevada Flying Squirrel

The single specimen of flying squirrel in our collection from within the Lassen section was caught, September 29, 1923, in a steel trap near Warner Creek at 6600 feet altitude. The trap had been set for a red fox. It was placed in front of a small burrow down which the skinned body of a chipmunk had been placed. Snow several inches in depth surrounded the trap, though the trap itself was bare. The flying squirrel was a male and weighed 140 grams.

Early in the evening of June 12, 1925, a flying squirrel was seen sailing between the trunks of yellow pines and white firs at the Forest Service camp-ground near Mineral. There was still enough light for the observer to see the animal as it sailed down from a near-by tree and arrived with a ''thud'' on the tree trunk close to the observer's head as he lay prone on the ground. This thud was astonishingly loud, in the silence of the evening, sounding as might the impact of a wet dish-rag thrown against the tree. Then, scratchings were heard as the squirrel ran, as agilely as a chipmunk, up the trunk; presently it was seen to run down the trunk a ways, head foremost; in either position of the body the tail was held straight out behind and clear of the bark surface. It was thought likely that flying squirrels regularly visited this camp-ground for scraps of food (Dixon, MS).

People who lived near Lyonsville reported that flying squirrels had been encountered frequently in that vicinity.

Thomomys bottae leucodon Merriam

White-toothed Pocket Gopher

Pocket gophers of this race were obtained at: Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet (fig. 86). They were trapped at the edges of meadows and on flat ground near streams. Some gopher workings were seen on slopes that were covered with yellow pines. At Manton, gophers were trapped in orchards where the ground was being irrigated.

Three males trapped in April weighed 97.5, 114, and 119 grams. Four males trapped in early June weighed 103, 115, 128.5, and 190 grams. Weights of three April-collected females were 77.5, 85.5, and 93.5 grams. A series of females collected in early June weighed 71.5, 80, 81, 102, 109, and 111.6 grams.

A female trapped at Manton, June 4, 1926, contained three embryos.

Thomomys bottae navus Merriam

Red Bluff Pocket Gopher

Specimens were obtained at the following localities in the western end of the section (fig. 86): four miles south of Red Bluff, 300 feet; Red Bluff, 300 feet; Cone's, 270 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet.

Weights of six adult males trapped in May averaged 141.1 (118 to 186.7) grams. Seven adult or nearly adult females, trapped in May, averaged 103.8 (90 to 134) grams in weight.

Types of habitat in which this species was found were: sandy second-bottom; in gardens, grain fields and alfalfa fields; on the lava-block covered mesa (scarce); in the belt of blue oaks (close to Sacramento River above Red Bluff). Of these the alfalfa fields seemed to present best conditions, and more individuals were found to live there per unit of area than in other places. In 1911, on a ranch near the Sacramento River south of Red Bluff, "over 100" had been trapped in the one spring season in an alfalfa field (Alexander, MS). Near Mill Creek, in 1912, a farmer declared that he had killed "over 200 gophers" in a two- to three-acre alfalfa patch during one irrigation. The animals reinvade even such a floodable area very quickly, in less than one year (Storer, MS).

A young gopher, weight 30 grams, was caught at Dale's, May 20, 1924, in a mousetrap set in a *Microtus* runway in green grass along a ditch. Young were noted commonly near the mouth of Mill Creek, the second week of June.

In the series of *Thomomys bottae* preserved from within the section, 77 in number, there is no trouble in assortment as between the subspecies *navus* and *leucodon*; in other words, every locality tested produced one or the other race, as here listed, without equivocation. While continuity of range with accompanying intergradation of characters is, perhaps, to be expected, it is not as yet demonstrated in this region where their ranges closely adjoin.

Thomomys quadratus quadratus Merriam

Dalles Pocket Gopher

Present scatteringly in the eastern portion of the section (fig. 86) where specimens were obtained at localities as follows: five miles north of Fredonyer Peak, 5700 feet; near Termo, 5300 feet; Secret Valley, 4500 feet; Box Springs, 5300 feet. Workings, presumed to be of this species, were seen also in the extreme northeastern corner of the section, northeast of Red Rock P. O.

An adult male trapped in early October weighed 85 grams. Young gophers caught during the first week of July weighed between 45 and 66 grams. A female trapped on October 12 weighed 64.4 grams.

Gophers were trapped and mounds were seen, near Termo, on a flat rocky mesa where no green vegetation could be seen. Near Box Springs in 1925 gopher workings were limited to moist ground near springs and wet meadows. Local testimony was to the effect that these rodents were formerly much more numerous and widespread in this region than the collector (Dixon) found them to be in 1925. It was thought that series of dry years had so reduced the sustenance for *Thomomys* as to have resulted in the restriction noted in its population.

Thomomys monticola monticola Allen

Sierra Nevada Pocket Gopher

Present in the mountainous portion of the section from Battle Creek Meadows to the southwest end of Eagle Lake (fig. 86). Specimens preserved from following localities: Mineral, 4900 feet; Manzanita Lake, 6000 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet.

Five adult males (largest) from Warner Creek at 8000 feet and from Spalding's, September and October, ranged in weight between 112.8 and 163.3 (average 137.7) grams. The ten largest females (all adult) of the same places and season weighed between 111.5 and 144.4 grams, average 122. Most of the individuals taken at this season were young of the year that weighed less than 100 grams. Adults trapped in midsummer weighed less than 100 grams each.

In the vicinity of Mineral this gopher was confined rather strictly to a narrow belt around the big Battle Creek Meadows. None was found out in the level, floodable ground nor upon those hill slopes that were exceedingly rocky. Winter earth cores (fig. 160) in that vicinity occurred on well drained ground at the sides of meadows but not out in them. At Manzanita Lake workings were found in the loose, ashy soil. At two miles west of Black Butte gophers were trapped on sloping ground at the edge of a tract of alders along a creek and on dry, rocky ground on top of a ridge among scrub manzanita. Around the base of the cone of Lassen Peak, winter sign of gophers was noted wherever there was soil and a little vegetation.

Fig. 160. Winter earth cores made by Sierra Nevada pocket gopher (*Thomomys monticola monticola*) in snow and left exposed on the ground surface when snow melted in spring. Shows some of the large pebbles sometimes packed into these cores. Photograph taken April 19, 1929, at Battle Creek Meadows. Mus. Vert. Zool. no. 5866.

An examination in spring of the signs of winter activity under the snow in the vicinity of Mineral indicated that the gophers cut off or completely de-barked seedling and older coniferous trees encountered, as well as snow-brush twigs, the latter much more extensively. Young lodgepole and yellow pines that had been killed in this way were found in numbers. Some of them were simply yellow sticks—only slivers of wood left representing the stems of the little trees, the terminals and all the bark having been removed.

On the wind-swept open margins of the basin at 8300 feet altitude, in which lies Lake Helen, on May 17, 1924, when the snow had only partly left the ground, much evidence of winter work of *Thomomys* was seen on places bare of snow. Here grew a great deal of the prostrate, small-leafed, small-stemmed manzanita (*Arctostaphylos nevadensis*). Indeed, this was nearly everywhere the only plant to be seen, and it formed mats, 15 to 25 centimeters deep, of a yellow-green color many yards in extent, even covering acres up the south-facing ridge slope immediately to the northward. Here, in places, were seen abundant cuttings, green-cured though not intentionally so. Presence and juxtaposition of as yet undisintegrated earth cores and of plugged burrows showed these to be the work of *Thomomys*. Only the smallest terminal stems 2 to 3 millimeters in diameter had evidently been sought (and presumably eaten) by the gophers; these were gone, leaving as "kitchen middens" the leaves and certain of the coarser stems. There was no evidence that any leaves had been eaten (Grinnell, MS).

A female trapped June 29, 1924, at two miles west of Black Butte, contained five embryos. At the same place on July 6, a young gopher, weight 24 grams, was caught in the hand as it ran along on top of the ground beside a log. An adult female, possibly the mother of this one, had been trapped nearby the preceding night. One of the cheek pouches of the youngster contained many pieces of green grass.

During a few days of cold weather in mid-October, 1923, at Eagle Lake, pocket gophers that had been active previously did not throw up new mounds or travel the runways near the surface.

Perognathus parvus mollipilosus Coues

Coues Pocket Mouse

Near Box Springs, 5300 feet, a young pocket mouse was trapped July 10, 1925. The trap was placed on fine sand amid dense bushes at the edge of a dune. This was the only specimen of pocket mouse obtained in 500 trap-nights in that vicinity that year. In 1928, nearly 50 specimens were obtained as follows: at Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; one mile west of Red Rock P. O., 5300 feet. However, the factor of differing localities may have figured here rather than year-to year fluctuation. There is also in the Museum of Vertebrate Zoology a skin of this species that was obtained, by J. M. Willard, at Eagle Lake on October 26, 1899.

Weights of the four largest males obtained were: 22.4; 22.7; 23.6; 24.5 grams. The four largest females weighed: 20.1, 21, 21.2, 23.6 grams.

The types of situation in which specimens of this mouse were taken were as follows: in sedges by a spring; along rock fence at edge of weedy field; among "weeds" one meter high in field; among weeds along fence in dry wash; in clear space beside a small juniper bush; in and under clumps of sage-brush where soil was firm and where rocks were frequent at the surface; on loose sand among clumps of wild rye. Sufficient and suitable cover and food seemed to be more important in determining the presence of this species than did the type of soil.

The cheek pouches of one *Perognathus* taken eight miles southwest of Ravendale contained the large seeds of the antelope brush (*Purshia tridentata*) which occurred commonly there.

Three females trapped July 13, 14, and 16, 1928, each contained five embryos. Many young individuals nearly grown were being trapped at the same time.

Of the three localities where this species was found in 1928, it was most frequent at Petes Valley and least frequent at one mile west of Red Rock P. O., where only one individual, a young one, was trapped.

Dipodomys heermanni californicus Merriam

Northern California Kangaroo Rat

Specimens referable to this subspecies represent the following localities: ten miles north of Red Bluff, 500 feet; Blue Tent Creek, 300 feet; Coyote Creek, 270 feet; Manton, 2300 feet; Lyman's, 3300 feet; Petes Valley, 4500 feet. (See fig. 95.)

Weights, in grams, of three apparently adult males were 74.5, 76, and 87.7. Two females in which no embryos were found weighed 62 and 68 grams.

Townsend (1887, p. 177) ,speaks of sometimes finding kangaroo rats at Red Bluff "drowned in the water tanks at railroad crossings."

On January 1, 1928, indications that kangaroo rats were present were found by us on the open prairie ten miles north of Red Bluff. There, on the highest ground where the soil was gravelly and well drained, were found open holes and holes with entrances recently closed, and beaten paths leading from one hole or set of holes to another hole or set. At intervals a recognizable path led off down the slope to where the grass was thicker, to become imperceptible there, indicating that the animals were accustomed to go there to forage for seeds. In front of some of the burrows were cast-out accumulations of hulls of seeds and in front of all used burrows and along the paths at intervals were scattered the characteristic droppings—short, thick, blunt-ended, and slightly curved.

When this place was visited again, on April 10, following, it was evident that sets of the holes observed in the winter had been cleaned out and were then occupied by ground squirrels. The paths were much more clearly defined and the squirrels themselves were observed at the burrow entrances. Traps set on this ground caught kangaroo rats both in January and April, so that it was definitely established that they were present and active at both seasons. No ground squirrels were seen here in January.

Footprints and tail marks of *Dipodomys* in the dust of a road near Blue Tent Creek led to trapping there in May, 1924. Close by, burrows were found in hard, dry, clayey ground. The burrows had permanent, hard-walled entrance ways.

The observations just reviewed seem to establish that this kangaroo rat may use for homes the burrows that have been excavated originally by some other mammal and that in the western part of the section the adopted holes are those usually of the Douglas ground squirrel. While it is probable that these two rodents do not make active use of the same burrows at any one time, it does appear that the rats make use of the holes during the winter at the season when the squirrels are hibernating, in addition to taking over the holes that the squirrels abandon.

A colony of kangaroo rats was found, in the winter of 1927, living on a low stretch of ground (fig. 161) bordering Coyote Creek. Specimens were trapped here in midwinter a year later. The occupied burrows (fig. 162) in some cases appeared to be old dens of ground squirrels. Freshly thrown-out dirt at their openings, however, indicated that the kangaroo rats themselves were doing some excavating. Later, in April, 1929, when this site was visited again, the water in the stream was much lower than it had been in winter. Then, some freshly excavated burrows (fig. 163), on a moist gravel bar in the stream bed, were evidently the results of digging activity of kangaroo rats alone. It is possible that these holes were dug by individuals that had been driven out of the holes on higher ground, some of which were at that time occupied actively by ground squirrels.

Fig. 161. Coyote Creek below (east of) highway. Northern California kangaroo rats (*Dipodomys heermanni californicus*) were trapped in January, on the ground shown between the fence and the creek bank. The pools here shown in the creek bed disappear in the summer. Photograph taken April 17, 1929. Mus. Vert. Zool. no. 5871.

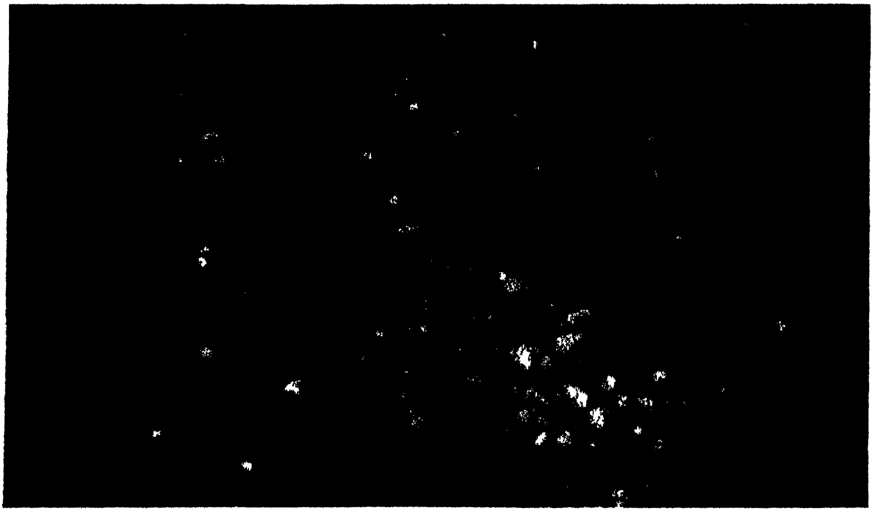


Fig. 162. Burrow of a type at which northern California kangaroo rats (*Dipodomys heermanni californicus*) were trapped; shows hard, firm walls at entrance. Photograph taken April 17, 1929, at Coyote Creek. Mus. Vert. Zool. no. 5869.

The kangaroo rats taken at Lyman's were trapped in a dusty trail between a rail fence and a slope covered with manzanita. The one specimen from Manton was trapped in a clearing on a dry hillside surrounded by broken scrub oak and digger pine. At Petes Valley one of the two kangaroo rats caught was trapped in July, 1928, close to a rock fence. The other one was caught at the entrance of a burrow, thought to have been made by an Oregon ground squirrel out in the hard soil in the center of the valley.

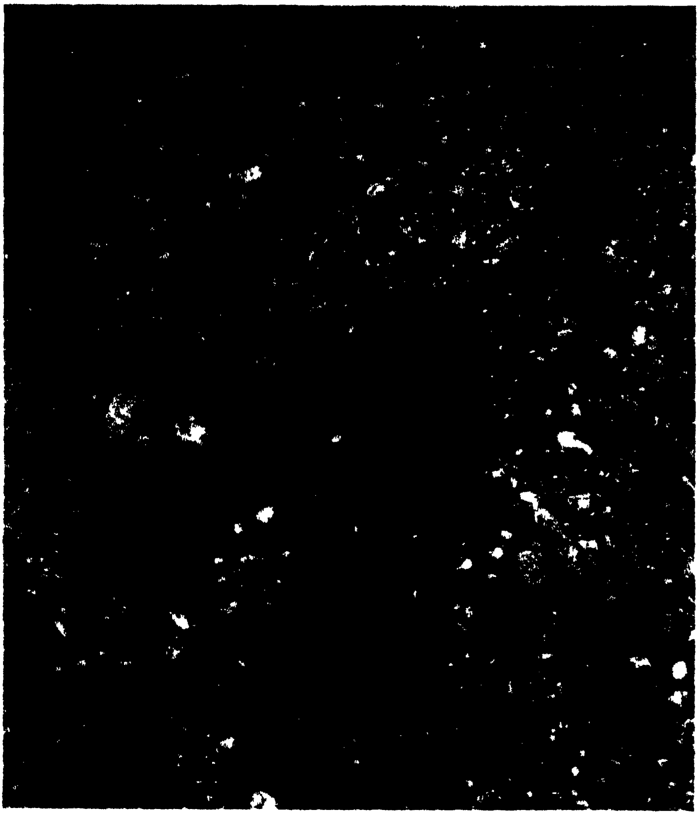


Fig. 163. Burrow of northern California kangaroo rat (*Dipodomys heermanni californicus*) in moist gravelly soil close to intermittent stream. Shows freshly excavated material at burrow entrance. Photograph taken April 17, 1929, at Coyote Creek. Mus. Vert. Zool. no. 5870.

A female that was trapped near Manton on June 4, 1926, contained two small embryos. A young female trapped June 15, 1924, at Lyman's weighed 29 grams; hence it was slightly less than half grown.

Only the one group of kangaroo rats was found to be represented in the western portion of the Lassen section, namely, the *heermanni* group; but it also was found in the eastern portion of the section, which is invaded by a representative of the totally different *ordii* group. An unexpected development was that the *heermanni* group in the western part of the section proved to be represented there by two distinguishable races, to one of which the animals in the eastern part must, at least tentatively, be referred.

In a published revision of the kangaroo rats (Grinnell, 1922, p. 42) three specimens from the D. R. Dickey collection were referred to "*Dipodomys heermanni eximius.*" We now have before us 13 specimens from the Dickey collection, including the three recorded ones, all, we are informed, from a point west of the Sacramento River two and one-half miles northwest of Red Bluff and collected by L. M. Huey, August 27 to September 4, 1919. This series as a whole looks paler colored than topotypical *californicus;* it is strikingly paler than *saxatilis,* captured less than 15 miles away, but across the river. In size of skull and body dimensions, this series departs from both *saxatilis* and true *eximius* (from the Marysville Buttes, Sutter County, California) toward *californicus* so as to lead us definitely to allocate it with the latter. The relative pallor may in part be due to the season of capture, just preceding the time of the annual molt; possibly also, to a difference in "make" of skin, by which the lateral brownish areas are spread out by the full stuffing.

The one specimen from Manton is darker colored than the examples of *californicus* from north of Red Bluff and from Lyman's, thus showing a tendency toward *saxatilis;* but in most of its dimensions it is nearer *californicus.* As far as the material goes, there is thus indicated the possibility of intergradation between *saxatilis* and *californicus* at about the 2000-foot contour. But this is purely conjectural; material along a suitable series of stations is lacking to prove the point. Our series of *saxatilis* is sharply and quite uniformly different from average *californicus* by the characters designated in the original description of the former (see Grinnell and Linsdale, 1929).

Within the Lassen section, the Sacramento River in the vicinity of Red Bluff might be looked upon as having had to do with the differentiation of the stocks close at hand on the two sides of the river. But the facts ascertained show that, without any such visible barrier, there exists a population farther up the piedmont slope, in the vicinity of Manton and Lyman's which bears the characters again of *californicus.* Habitudinally, there is a fair explanation of this in the open *rock*-strewn type of terrain in which *saxatilis* was found as compared with the more or less *chaparral*-clothed earth slopes where the specimens of *californicus* were taken.

A further distributional situation that came to light was the presence of representatives of the same group far to the eastward, in Petes Valley, which specimens, although not altogether satisfactory for exact determination, we place under the race-name *californicus*. As regards the immediate confines of our Lassen section, the representations in Petes Valley and at Lyman's are far separated from one another by territory inhospitable to any *Dipodomys*. But the situation is understandable from the standpoint of the general range of the race *californicus* (see map in Grinnell and Linsdale, 1929, p. 456), from which it appears likely that continuity of occurrence is very nearly complete by way of the head of the Sacramento Valley and the Pit River gap to the Upper Sonoran portions of the western margin of the Great Basin, east to the east side of Tule Lake, Modoc County, at the north, to Hat Creek, due north of Lassen Peak, and now to Petes Valley due east of Lassen Peak.

Dipodomys heermanni saxatilis Grinnell and Linsdale

Stony-ground Kangaroo Rat

Kangaroo rats that were obtained in numbers within one mile of Dale's, 600 feet, were made the main basis of the description of this new subspecies (see Grinnell and Linsdale, 1929). Other individuals were trapped at eleven miles southeast of Red Bluff, 300 feet, and two and one-half miles northeast of Tehama, 400 feet. The range of this subspecies thus lies altogether at low levels (300 to 700 feet) and east of the Sacramento River. (See fig. 95.)

Seventeen males, trapped in late May, weighed between 53 and 70 (average 60.2) grams. Seven non-pregnant females caught at that time weighed between 41.5 and 62.5 (average 50.4) grams. Three females trapped in December weighed 53, 54.8, and 57.5 (average 55.1) grams.

The rats in the neighborhood of Dale's were caught on the mesa on either side of Paine's Creek, where lava blocks were thickly strewn over the ground (fig. 72). Occupied holes which opened under the lava blocks were believed to have been excavated by the animals themselves. Accumulations of seed hulls were found in cavities beneath some of the boulders that could be lifted.

In late December, 1924, just after a snowfall on this mesa, when nothing could be seen above the snow except the larger rocks, tracks of kangaroo rats were found leading to and from protected places under the edges of boulders and extending far and wide over the bare snow surface. The animals were evidently quite active, and some were trapped on nights when the temperature reached many degrees below the freezing point.

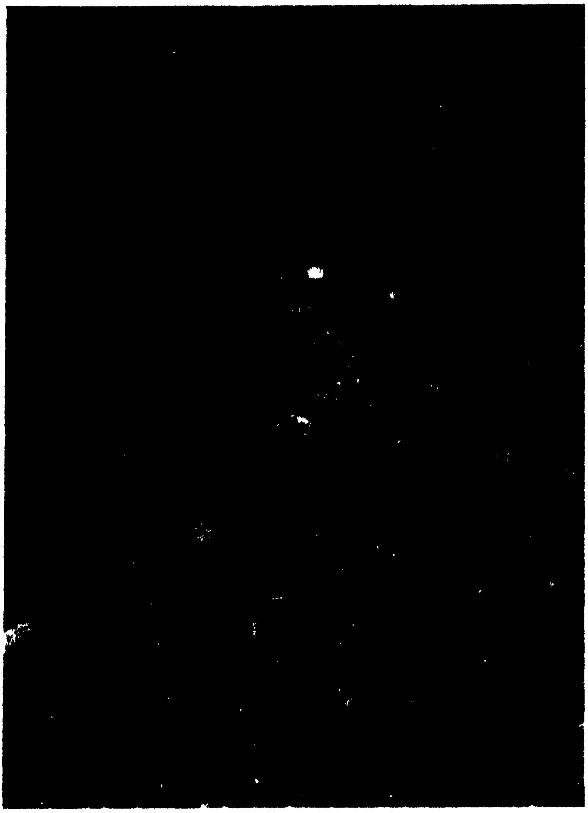


Fig. 164. Entrance to burrow of stony-ground kangaroo rat (*Dipodomys heermanni saxatilis*) on well drained slope; shows scant cover of vegetation on these slopes in spring. Photograph taken April 20, 1929, two and one half miles northeast of Tehama. Mus. Vert. Zool. no. 5868.

At the trapping locality northeast of Tehama individuals were found active in January, 1929, living in burrow systems on the low ridges just above the floor of the valley. There the soil was sloping and well drained. Nearly all the occupied burrows (fig. 164) were close to the edges of the flat-topped ridges between the shallow washes. Apparently the kangaroo rats excavated their own burrows at this place. A few miles farther north along the eastern edge of the Sacramento Valley floor, the rats were living in rockier places where they might use as shelters the boulders that were scattered over the slopes which marked the lower edge of the piedmont region.

Cheek pouches of summer-taken rats contained chiefly seeds of alfilaria. Those examined in winter were crammed with green stuff: alfilaria leaves in pieces, sections of grass blades, and the like.

Of the females trapped May 24 to 26, six contained two embryos each and three contained three embryos.

Dipodomys ordii columbianus (Merriam)

Columbian Kangaroo Rat

Occurs in the extreme eastern part of the section where specimens were obtained at: Petes Valley, 4500 feet; Dransfield's, 5300 feet; one mile west of Red Rock P. O., 5300 feet; Box Springs, 5300 feet.

Weights of twenty-two females trapped at Box Springs in October ranged between 43.5 and 58 (average 50.9) grams. Weights of three July-caught females from Box Springs averaged 58.3 (57 to 60) grams. Twenty-nine males from Box Springs in October weighed between 46 and 56.7 (average 51.3) grams. Three from Box Springs in July weighed 55, 56 and 62 (average 57.6) grams.

During October, 1924, kangaroo rats were found to be especially numerous near Box Springs. Here they were trapped in a large field that had been planted to rye the previous year. The field was bordered by a wide strip of sandy ground where weeds furnished shelter for the rats while foraging abroad. In nearly all of the several burrow systems that were excavated, nests of shredded weed stalks were found; but no well marked food stores were located. This was in a locality where heavy winter snows sometimes occur and it seemed that food stores might be needed.

A kangaroo rat that had been slightly injured by a trap-hit was liberated (fig. 165) and was watched as it dug into the sand. The front feet were used together, not alternately, to throw the sand back between the widespread hind legs. When a considerable amount of sand had been thus accumulated it was kicked back farther by the hind feet. This animal dug directly to a used tunnel below the surface through which it quickly escaped.

During the third week of October, 1924, kangaroo rats near Box Springs became active in the evening at about the time the stars became visible. On October 18, twenty-five traps were set out, beginning at six o'clock. By the time the last trap had been set, twenty minutes later, seven rats had been caught in the trap line.

At one place an acre of ground was marked off and traps set there each night until no more rats were caught. In all, thirty-five were trapped on this acre. That number was thought to represent a maximum for the vicinity. It was estimated that ten rats per acre was the average for this territory at that season (Dixon, MS).

Two live kangaroo rats that were placed together in a cage fought by biting and by kicking with their hind feet. They also made a chattering noise with their teeth.

Fig. 165. A live Columbian kangaroo rat (*Dipodomys ordii columbianus*) that had been slightly injured by a trap hit. Photograph taken July 8, 1925, at Box Springs. Mus. Vert. Zool. no. 4705.

A female trapped, July 7, 1925, near Box Springs contained four embryos each fifteen millimeters long; another one contained five embryos each twenty millimeters long.

In early June, 1929, several individuals were trapped in various places in Petes Valley. Rather extensive though scattered workings of kangaroo rats were found June 9, on a stretch of gravelly, gently sloping ground on the north side of the valley. There was much sign of digging activity, not only in the burrows, but where little diggings had been made here and there to unearth, presumably, sprouting seeds. Traps set here caught two kangaroo rats. Some of the holes had ground squirrel droppings at their entrances, and at some, dirt was thrown out during the daytime. Evidently the two kinds of animals were occupying common ground if not the same burrow systems.

Microdipodops megacephalus oregonus Merriam

Oregon Kangaroo Mouse

The vicinity of Box Springs, 5300 feet, and one mile west of Red Rock P. O., 5300 feet, where specimens were obtained, are the only places in the section where this species has been found.

A series of six adult males averaged 12.5 grams in weight. Eight adult females also averaged 12.5 grams.

Traps that caught mice of this species were placed on low dunes of loose and drifting sand (fig. 29), or on sandy ground beneath or near clumps of rabbit-brush, sage-brush, and a kind of bunch grass (*Elymus condensatus*) (fig. 28). On several occasions two and even three individuals were trapped at the same place on consecutive nights, so that the population must have been fairly dense.

Tracks of this species resemble, except for size, those of *Dipodomys*. In fine sand, visible marks are left by the tail. One trapped kangaroo mouse had dry remains of a black wasp in its cheek pouches. A female trapped July 5, 1925, contained three small embryos. Two small embryos were found in one trapped July 7. A nearly grown male, weight 10 grams, was trapped on July 9, and a young female weighing 8 grams on July 10.

Our twenty-seven specimens of kangaroo mouse from localities in the eastern end of the Madeline Plains at once showed themselves to be quite different racially from *Microdipodops californicus*, named from near Vinton, Sierra Valley, Plumas County, California, though only about seventy miles of territory intervene. The differences lie both in color and characters of skull. As compared with *californicus* the east-Lassen animal is in color not so clearly olivaceous brown dorsally, there being a greater intermixture of black; the tail averages blacker toward tip, above, and buff, not grayish-white, beneath; upper fold-over of ear not silvery-white but dusky buff, like rest of ear; skull somewhat larger, bullae more inflated, and depth of cranium as viewed from behind, greater.

When, on the other hand, comparison was made with a series of kangaroo mice from Little High Rock Cañon, Washoe County, Nevada, a locality some sixty miles away to the northeastward, close concordance was seen. And these latter examples had already been studied by the senior author in comparison with the types of all the then described forms of *Microdipodops* and identified as *M. megacephalus oregonus*. It would appear, then, that a "lava-beds" race exists, of quite extensive though doubtless intermittent distribution in northwestern Nevada, southeastern Oregon and extreme northeastern California, quite separable from the more southerly races, along the eastern border of California and in Nevada.

Onychomys leucogaster fuscogriseus Anthony

Gray Grasshopper Mouse

Two females of this species were trapped in sandy ground near Box Springs, 5300 feet, on October 20, 1924, and July 7, 1925. The one caught in July was a nursing individual. It weighed 34 grams. Of this weight, the mammary glands made up two grams, and the stomach and its contents five grams. The other individual weighed 25.5 grams.

Reithrodontomys megalotis megalotis (Baird)

Desert Harvest Mouse

Specimens collected at Petes Valley, 4500 feet, and Red Rock P. O., 5300 feet. (See fig. 108.)

Weights of seventeen males, collected in July, ranged between 9 and 12.6 (average 10.8) grams. Weights of three females were 10.9, 11.2, and 11.5 (average 11.2) grams.

This race of harvest mouse was trapped among sedges and grasses along sloughs, in weeds at the edges of fields, at the borders of washes, then dry, running through sage-brush, and under bushes of sage-brush on floors of valleys. Apparently, the first named situations were frequented more than the last named.

Three females obtained on July 14, 1928, each contained four embryos. One trapped July 15 had two embryos.

Reithrodontomys megalotis longicaudus (Baird)

Long-tailed Harvest Mouse

Found in the section only west from Battle Creek Meadows, and below the 4900-foot level (fig. 108). Specimens obtained at the following stations: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Battle Creek Meadows, 4800 feet.

The weights of five males, apparently adult, ranged from 9.5 to 12.8 grams; average 10.7. Two adult females in which no embryos were found weighed 11.5 and 12.2 grams.

Some of the types of situation in which harvest mice were trapped were described by the collectors as follows: under willow in damp place; at edge of a creek; in lush grass at side of ditch; in damp, red clover field; in *Microtus* runways in green grass along ditch; amid dry leaf litter beneath willows; under blackberry-vine tangle; among clumps of grass; at edge of hay field; among jagged rocks on shrubby hillside near meadow edge.

A female containing three embryos and one containing four were trapped near Red Bluff on May 6 and 7, 1924. A female containing four embryos was trapped at Manton, June 3, 1926. One that was obtained at Lyman's on June 14, 1924, contained five embryos. Young individuals nearly full grown were trapped around the first of June in the vicinity of Dale's.

Peromyscus crinitus crinitus (Merriam)

Idaho Cañon Mouse

A single female, weight thirteen grams, was trapped in the rimrock at Slate Creek, 5700 feet, near Grasshopper Valley, September 28, 1924. Three males were trapped, October 1, 2, and 3, 1924, at five miles north of Fredonyer Peak, 5700 feet. These three were caught on a rocky hillside covered with sage and mountain mahogany. Their weights were 12, 13.1 and 20 grams.

Peromyscus maniculatus gambelii (Baird)

Gambel White-footed Mouse

At every locality where traps were set to catch mice this subspecies of white-footed mouse was taken. For full list of trapping stations, see introduction, page 10.

The following list of kinds of places where individuals of this mouse were caught, even though incomplete, illustrates the great range of surroundings in which it lives in the section. Under lupine bush on hard-packed ground, sparsely grassy; on prairie type of ground where only kangaroo rat burrows were in evidence; among lava blocks on mesa with here and there clumps of buck-brush and blue oaks; in lush grass; under drift wood and willows along river; about logs, stumps, and rocks on hillside; among grass and weeds; in meadow mouse runway on creek bank; in trap set in creek-side stump for water shrew; in chaparral bordering firs; under fir; under rotten logs among red firs; in clump of *Holodiscus;* in heather; in bare rock slide; at edge of lake near alders; among lupines and willows about springs; beside clump of willows in over-grazed meadow; on rocky hillside covered with sage-brush and mountain mahogany; among junipers; in tent; in farmhouse; on snow on boulder-strewn lava plain; along stone fence; under blackberry bushes on river bank; on sand amid sage-brush and wild rye; under rocks among sage-bushes; in, and at edge of, field; on moist ground in hay field; in grass and sedge on beach of lake; along undercut bank at shore of lake.

Wherever observations were made, up to 6000 feet altitude, in the extreme eastern end of the section, this mouse appeared to be quite as active in midwinter as in summer.

Females containing embryos were trapped at the following places, date and number of embryos given in each case: Dale's, May 22, 1924, 3; Lyman's, June 14, 1924, 3; Mill Creek at 7000 feet, May 17, 1924, 6; eight miles southwest of Ravendale, July 18 to 20, 1928, 3, 3, 3, 3, 3, 4, 5, and 5; Red Rock P. O., July 21 and 22, 1928, 4 and 4. A blue-pelaged, not full-grown, young one was obtained at Lake Helen, 8200 feet, July 14, 1924.

In Petes Valley no embryos were found in any of the females examined for them from July 12 to 16, 1928. From July 17 to 21, 1928, at the station southwest of Ravendale, most of the adult females contained embryos. Apparently, there is some definite difference in the seasonal cycles of breeding activity between the mice of these two stations, although they are separated by only a few miles. At each of the places a sufficient number of females was captured to represent fairly the population.

Abundance of this species of white-footed mouse in the eastern end of the section in July is indicated by the following figures. At Petes Valley, 320 trap-nights gave 23 mice of this species. At the station eight miles southwest of Ravendale, 255 trap-nights gave 44 mice. In the vicinity of Red Rock P. O., 392 trap-nights gave 37 mice of this species. Thus, in the three localities, 967 trap-nights, in the month of July, produced 104 individuals of *P. m. gambelu;* and this was the record of one collector (Lamb, MS).

In January, at Dransfield's, with snow on the ground, 265 trap-nights gave 20 *P. m. gambelii* (Borell, MS). This might indicate a lesser midwinter population, only there was the factor of snowfall to interfere with the trapping in midwinter; and a marked place-to-place variation in numbers is shown in the first figures given above, suggesting another factor modifying the seeming ratio of winter to summer populations.

One hundred and five skins-with-skulls of this ubiquitous mouse were saved from the section. This series shows the usual wide variations according to age and season, fully described by Osgood (1909). In addition, we perceive a tendency toward paleness of the brown tones of coloration, and restriction of black, in the eastern, Great Basin end of the section, from Eagle Lake eastward. This observed tendency to pallor obviously means intergradation with *Peromyscus m. sonoriensis,* the subspecies which reaches its best development farther to the eastward and thence southward, in the main Great Basin and desert territory.

Two examples (nos. 35195 and 35313, old adults, of dates October 19, 1924, and July 7, 1925), from Box Springs, at the extreme eastern end of the section, are the palest in our entire series. If considered alone, they could well be referred to *sonoriensis*. But the rest of our material from the near vicinity shows that these two are extremes in a population the mean of which is on the *gambelii* side of a mid-line of characters between the two subspecies. A human factor here entering, and which must be taken into account, is that in a mammal being trapped nightly in numbers, the tendency is for the collector to save as specimens "adults," that is, the brightest colored examples. Then, too, it was realized that the pale race, *sonoriensis*, was to be sought for in the collecting done in the arid portion of the section, with the result that, when it came to putting up the morning's catch, preference would likely be given to the extremes in this direction.

Peromyscus boylii boylii (Baird)

Boyle White footed Mouse

Found in the western part of the section below the 3300-foot contour line. Specimens collected at: Red Bluff, 300 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet.

Weights of sixteen adult males trapped in May and June averaged 27.4 (20 to 39) grams. Eleven females without embryos and trapped in May and June averaged 27.1 (20.8 to 35.3) grams.

This mouse was obtained in such situations as the following: beneath willows where there was dry, dead leafage strewn over sand; under grapevine which clambered over a stack of old drift near the river; under valley oaks overgrown with wild grapevine; in field of red clover; under lupines, along a grass-grown fence; on the side of lava escarpment, mostly under stubby buck-brush, with usually rocky crevices near-by and often blue oaks growing overhead; among rocks bordering a cañon.

Two females trapped at Lyman's, June 9 and 11, 1924, each contained three embryos.

Peromyscus truei truei (Shufeldt)

True White-footed Mouse

Two specimens of this mouse were trapped at five miles north of Fredonyer Peak, 5700 feet, on October 1 and 3, 1924. Both were caught on a rocky hillside covered with sage-brush and mountain mahogany. One, a male, weighed 28.5 grams; the other, a female, 24.1.

Peromyscus truei gilberti (Allen)

Gilbert White-footed Mouse

Specimens obtained on the western slope of the mountains west of, and below, the 3300-foot contour line, at the following places (fig. 109): Blue tent Creek, 300 feet; Red Bluff, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet.

Weights of eleven males trapped in May and June averaged 26.7 (22 to 34.4) grams. Weights of six adult females without embryos and of the same season averaged 27.2 (20 to 32.6) grams.

Near Red Bluff this mouse was trapped beneath grapevines along stream courses. At Dale's it was caught in traps that were set up the side of a lava escarpment, mostly under stubby buck-brush with usually rocky crevices near by and often blue oaks growing overhead. Vegetation otherwise was sparse. Trapping there demonstrated that this species ventured out into perfectly open, unsheltered ground where no sign of mice could be detected.

Two females trapped at Dale's, May 22 and 23, 1924, contained three and two embryos, respectively.

At Dale's, a trap line was kept going, along the side of a mesa escarpment as above described, five nights, May 19 to 23, 1924. A total of 245 trap-nights was represented by the time the line was taken up on the morning of the 23rd. The mice trapped numbered 143, or a 60 per cent catch! The kinds included were *Microtus* (few) and *Peromyscus* of the three species, *maniculatus, boylii* and *truei,* the latter in greatest proportion. Mr. Dale was evidently right when he said that his ranch was simply overrun, that year, with mice. He attributed this "plague" to the fact that the poisoners and trappers had "killed off all of the skunks."

In the above 5-days' catch it was noted that the proportion of blue-pelaged young, especially of small young, increased toward the last of the period. It was thought that the young bereft of their parents were forced by hunger to go out and forage prematurely.

An attempt was made to use the above figures as the basis of estimating the population of these wild species of mice. But the line ran up a hillside, zigzagged through rocky ground, and circled around, so that merely the grossest sort of an estimate could be arrived at with general regard to the ground covered. This population estimate was 60 mice per acre (Grinnell, MS).

Neotoma intermedia nevadensis Taylor

Nevada Wood Rat

Found in Petes Valley, 4500 feet, where seven were trapped in July, 1928, and eight in June, 1929. Seven males ranged in weight from 105 to 172 grams, averaging 143. One female weighed 97 grams.

Homes of this wood rat were found in the rocky sides of Petes Valley and in human-built rock walls on the floor of the valley. A few were present among lava blocks scattered over flat ground on the mesa above the level of the valley.

An abode of this wood rat was examined, June 8, 1929, in a natural lava-block jumble on a slope at the edge of Petes Valley. Here there was fully a bushel of materials accumulated beneath and between boulders, reaching a maximum width of mass of rubbish, of 28 cm. (measured) and a depth of 40 cm. (estimated). The materials were loosely piled together, in the newest parts of the mass, matted and rotting elsewhere. They consisted of: flakes of rock up to a diameter of 63 mm. and a thickness of 12 mm.; fragments of sage-brush, from twigs with fresh leaves, up to gnarled stalks and old weathered sections of stems; sections of juniper branches up to 25 mm. in diameter and 230 mm. long; fresh juniper twigs with yellow-green foliage, the nearest tree, a small one and the only one within hundreds of meters, standing about 30 meters away, rocks continuing all the way; several limb bones of sheep; pieces of cow manure; and tufts of dry grass, as if pulled up bodily. The most conspicuous associated vertebrates in this habitat were porcupines and rock wrens.

In critically examining the fifteen specimens (nos. 39852–58 and 41321–28) of desert wood rat obtained within our section, we quickly came to the conclusion that they are uniformly and conspicuously different from *Neotoma intermedia desertorum* as represented by long series from the Colorado and Mohave deserts and the southern parts of Nevada. And furthermore, we found them to show quite accurately all the more important of the characters set forth by Taylor (1909, pp. 289–296, pls. 27–29) when he named *Neotoma nevadensis* (see also Taylor, 1911, pp. 243–249). We have reviewed Taylor's material, as well as additional specimens of *nevadensis* that have reached this Museum since 1911.

As a result of our review we find ourselves compelled to disagree with Goldman (1910, p. 76) when he synonymized *nevadensis* under *desertorum*. Indeed, we are inclined to consider *nevadensis* as one of the best marked members in the series of forms in the "desertorum group." Our Lassen County skins are darker colored, even, than in the type series of *nevadensis,* while cranially they are the same throughout and by skull characters alone corroborate the tenability of *nevadensis.*

Neotoma fuscipes streatori Merriam

Streator Wood Rat

Found by us in the section at stations west of, and below, the 3300-foot contour line. Specimens represent the following localities: Red Bluff, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Payne Creek P. O., 1600 feet; Manton, 2300 feet; Lyman's, 3300 feet.

Two males that were trapped in summer at Dale's and Lyman's weighed 304.5 and 309.1 grams, respectively.

In the lower part of its range within the section this wood rat was trapped close to the streams in accumulations of drift, in willow thickets, and beneath tangles of grapevines. At higher altitudes homes of this species were built in the thick clumps of chaparral (buck-brush and scrub oak), within logs, stumps, and thickets among digger pines, in corners of old buildings, and beneath or between large rocks in cliff-like cañon walls (fig. 80). Apparently, two factors important in the choice of a home site in this species are availability of material for nest-building and cover of such a nature as to provide a screen when gathering these materials and when foraging for food. Presence of crevices or hollows seems also a favoring circumstance.

At Lyman's, nests composed in part of green tips of cedar boughs were situated in two old cabins, two nests in an attic, one on the ground floor, and one on a shelf. At Dale's, an adult Streator wood rat was trapped December 31, 1924, in the occupied dwelling house where it had been heard at night "rattling around" and "tapping" for some time previously.

At mid-afternoon of April 18, 1928, a wood rat near Manton was come upon in the midst of a thicket of scrub oak. Although the animal was in an apparently strained position, clinging among branches some two meters above the ground, it made no perceptible move from the time it was discovered until after the lapse of twenty-five minutes, when it made a slight shift. Then the observer who had been standing four meters away moved closer and the animal completely broke its pose and ran down through the branch-work and away (Linsdale, MS).

At Manton, around June 1, 1926, nine out of eleven wood rats that were trapped were females. Embryos were found in five of the females. One contained one small embryo and four contained two each. A female containing two large embryos was trapped at Lyman's, June 9, 1924. A young male, weight 105.8 grams, was trapped at Manton, June 1, 1926.

Neotoma cinerea occidentalis Baird

Western Bushy-tailed Wood Rat

Occurs in the section from the vicinity of Battle Creek Meadows eastward. Stations whence specimens were obtained are as follows: Battle Creek Meadows, 4800 feet; two miles west of Black Butte, 6800 feet; Lake Helen, 8200 feet; Warner Creek at 8300 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet; Spalding's, 5200 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet; Termo, 5300 feet; Dransfield's, 5300 feet; Box Springs, 5300 feet.

The three heaviest of twelve males from the section weighed as follows: 414 grams, two miles west of Black Butte, July; 422 grams, Kelly's, July; 500 grams, five miles north of Fredonyer Peak, October. Weights of the three heaviest of thirteen females are as follows: 340 and 395 grams, two miles west of Black Butte, July; 384 grams, Termo, October. It appears that in this species the males attain a greater weight than do the females.

In the higher central portion of the section bushy-tailed wood rats were found in rock slides and about boulders, for the most part in just such situations as the species has been found to inhabit commonly in other localities.

A nest that was found at the base of a large slide amid boulders close to Warner Creek at 6600 feet was peculiar because of the materials that had been used in its construction. The rat had carried to the place many small flat stones and with them had filled in the crevices. The structure measured a little over a meter across and one-half meter in height. A few bits of dry wood had also been used. (See fig. 166.)

In the eastern part of the section this wood rat was found to be living regularly not only amid rocks, where such occurred, but also in juniper trees, even in localities where there could be no access to retreats or dens among rocks. In most cases a rat or a family lived in the hollow of a tree, to which access had been gained through cracks in the outer shell of the tree or through holes which had been gnawed in the shell. In some cases the entrances may have been enlarged from holes made originally by woodpeckers. Within the hollow trunks were the nests ot the wood rats. In addition to the nests within the hollow tree trunks, most of the rats constructed houses among the branches of the trees. The materials used were pieces of dead sage-brush and tips of green juniper twigs. Most of these structures were built against the main trunks of the trees at heights less than three meters above the ground, although sometimes they were as far up as six meters. Most of the occupied trees were living ones, but at Eagle Lake some high-water-killed junipers were occupied. That the animals use these "outside" houses for resting places in the daytime was established by driving individuals from them on several occasions. (See figs. 167 and 168.)

Fig. 166. House of a western bushy-tailed wood rat (*Neotoma cinerea occidentalis*) made by carrying small pieces of rock to fill the spaces between large rocks. Here is evidence that this animal uses for home-building the nearest transportable material available, whatever its nature. Photograph taken September 20, 1923, near Warner Creek at 6600 feet. Mus. Vert. Zool. no. 4223.

Large accumulations of feces were found in the cavities of some of the trees that wood rats occupied, or in heaps at the bases of the trees.

In the neighborhood of Box Springs at a place where there were no trees, hills or rocks within two miles, wood rats were living in deserted buildings. Near Dransfield's individuals were trapped beneath rocks and in rock piles in the sage-brush. (See also fig. 169.)

It seems, then, that the habit of living in trees in the eastern part of the Lassen section is not so much a change in the habits of the species as it is evidence of capacity in the species to make use of sites for homes which may appear to us to differ from those which are ordinarily chosen, but which in vitally essential respects are really very similar. It may be that, judged on a basis of the "niche" requirements of the rats, there is actually little difference between the rock slides and hollow trees.

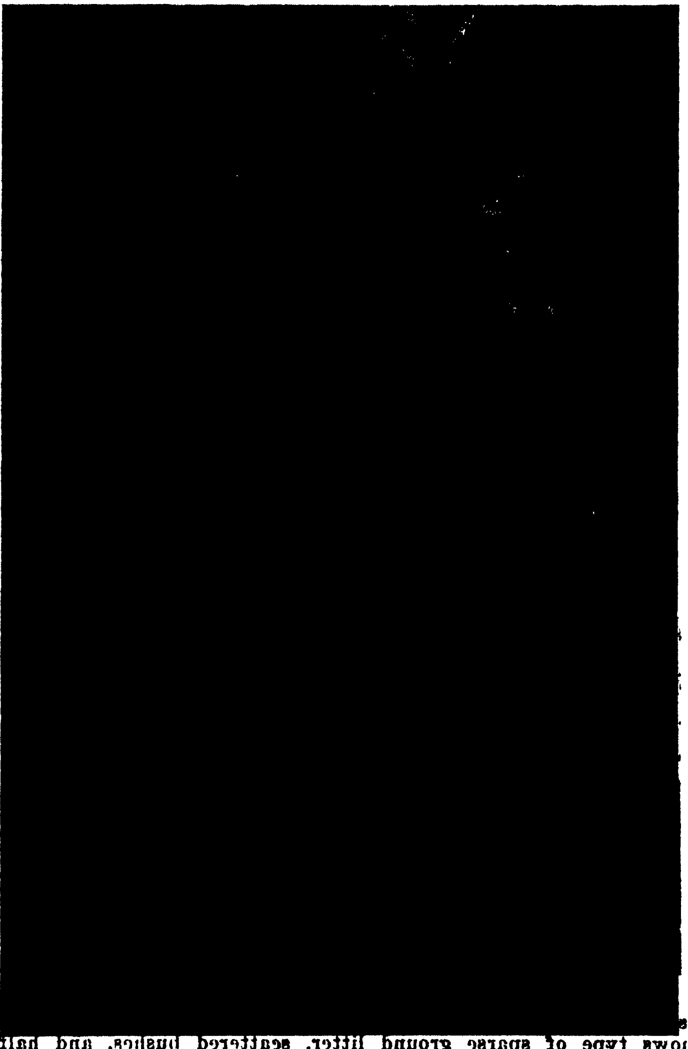


Fig. 102. House built by (western) bushy-tailed wood rat (*Neotoma cinerea occidentalis*) next to main trunk of a juniper two meters above the ground. Dead sticks and the terminal twigs of juniper made up most of the house. Photograph taken October 3, 1924, at a place five miles north of Fredonyer Peak. Mus. Vert. zool. no. 4516.

An instance of daytime activity of this species was noted near Kelly's, July 30, 1924. At 4 p.m. an individual was seen to make several trips to a gooseberry bush where it was getting the berries

A species of large black ant was especially numerous at the station two miles west of Black Butte in early July, 1924. These ants would begin eating small mammals as soon as they were trapped. One wood rat that was trapped had the heads of three of these ants clinging to its feet Apparently, the ants had attacked the live rat and had been bitten in parts by the rat, the heads being left attached.

Fig 168. Typical large western juniper, in the top of which is to be seen a "house" of the western bushy tailed wood rat (*Neotoma cinerea occidentalis*) Also shows type of sparse ground litter, scattered bushes, and half buried boulders characteristic of this habitat (see p. 65). Photograph taken October 10, 1924, near Termo. Mus Vert Zool. no. 4514

In the neighborhood of Termo it was estimated (Dixon, MS) that the bushy-tailed wood rat population was about one rat to the acre. At that place the animals were all living in trees.

A juvenile, weight 105 grams, was trapped June 25, 1924, at Battle Creek Meadows. Young ones, ranging in weight between 104 and 177 grams, were taken in early July at two miles west of Black Butte. One trapped at Box Springs, October 18, 1925, weighed only 149 grams.

Fig. 169. Home site of a western bushy tailed wood rat (*Neotoma cinerea occidentalis*); an instance of large crevices in the rock outcrop having been used, these being nearly filled with dead sticks and other trash. Photograph taken October 3, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4513.

Evotomys mazama Merriam

Mazama Red-backed Mouse

Three males of this species were trapped at two miles west of Black Butte, 6800 feet, on July 5 and 7, 1924. All three were caught beneath a log among red firs and close to a clump of alders by a small stream. The third individual trapped was caught in the daytime and before 2 p.m. The trap had been set in the same place for seven nights before July 5. During that time two shrews and one white-footed mouse had been captured in it. Weights, in grams, of the three red-backed mice were 25, 26.5, and 30.

Merriam (1899, p. 73, footnote) records that *Evotomys mazama* had been obtained "on Lassen," and Mailliard (1923, p. 32) reports a specimen taken one-half mile west of Quincy, Plumas County. The latter station, less than 30 miles south of the southern boundary of our Lassen section, is, to date, the southernmost known one toward the main Sierra Nevada.

Microtus montanus yosemite Grinnell

Yosemite Meadow Mouse

The Yosemite meadow mouse was found over a large part of the section eastward from Turner's and at altitudes up to 5500 feet. Specimens were preserved from the following places: Turner's, 3500 feet; Battle Creek Meadows, 4800 feet; Drakesbad, 5500 feet; Eagle Lake Resort, 5200 feet; Spalding's, 5200 feet; Petes Valley, 4500 feet; Dransfield's, 5300 feet; Red Rock P. O., 5300 feet.

Weights of the ten heaviest males trapped were as follows: Turner's, April, 44.5 grams; Battle Creek Meadows, June, 49.2; Drakesbad, October, 46.4; Spalding's, October, 35.3 and 54.9; Eagle Lake Resort, May, 55; Petes Valley, July, 55.5; Dransfield's, October, 33 and 53; Red Rock P. O., July, 40.8; average, 46.8. The seven heaviest females, without embryos, ranged in weight from 31 to 54.3 grams (average 42.5).

Ordinarily, this kind of mouse lived in well marked systems of runways in patches of rankly growing vegetation on water-soaked ground. As the marshy places or wet meadows were reduced in area each summer by evaporation, often assisted by grazing (fig. 21), the mice would leave the dried-out burrow systems and would go to the more moist situations.

In midwinter at Dransfield's a male was trapped beneath a pile of fence posts on hard rocky ground. Another individual was caught in a meadow beneath willow saplings.

Observations were made, April 19, 1929, on a portion of Battle Creek Meadows where the snow had only recently melted and where no new vegetation had grown up. There many runways and burrows (fig. 170) were seen where they had been made beneath the snow. The form and positions of the burrows showed that considerable activity had taken place on that area beneath the protective cover of snow. Apparently the time between the melting of the snow and the growth of a protective cover of new vegetation constituted a dangerous period of the year for meadow mice. Aside from increased danger

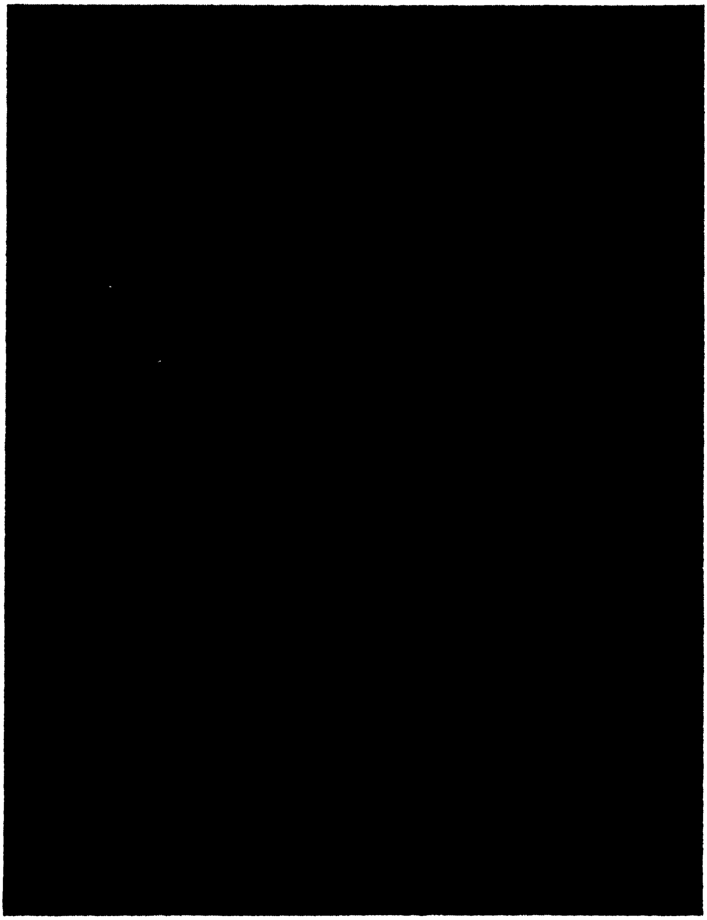


Fig. 170. Runways made by Yosemite meadow mouse (*Microtus montanus yosemite*) in winter beneath snow on edge of meadow. Here the snow replaced thick vegetation in providing cover, while the roots and tubers of the plants provided winter food. Photograph taken April 19, 1929, at Battle Creek Meadows. Mus. Vert. Zool. no. 5867.

from predators, there was an added danger from flooding at that time. The first danger was partly met by the animals staying in burrows under ground. The second type of danger was overcome by restricting the area occupied to the higher and better drained ground at the edges of the meadows.

In the narrow marsh at the upper end of Petes Valley in 1928, runways covered all the ground that was not dry and where the water was not deep. At several places cut sections of stems of the large bulrush (*Scirpus*) growing there were seen in the runways. Grinding sounds thought to have been made by mice cutting the stems were heard beneath the thick cover several times during the morning when observations were made there. In 1929 runways and fresh cuttings were seen in all marshy places in the valley, even in places that, the previous season, had been dry and, hence, unoccupied by meadow mice.

Embryos were found in trapped females as follows: Turner's, April 26, 5; Battle Creek Meadows, June 25, 4 and 6; Drakesbad, October 5, 5; Eagle Lake Resort, May 22, 9; Red Rock P. O., July 25, 5.

Variation in our series of thirty-four specimens of this species of *Microtus* from within the section is great. Certain examples from the vicinity of Red Rock P. O. are very dark-colored, even blackish middorsally, as contrasted with, for instance, animals from Battle Creek Meadows, which are grayish brown dorsally. However, the same wide variation of color is observable elsewhere in the general range of *M. montanus yosemite,* and so we consider it as without geographic significance here.

Microtus californicus eximius R. Kellogg

Sanhedrin Meadow Mouse

This meadow mouse was found widely in the western part of the section up to as high as the 3500-foot contour line. We trapped specimens at the following localities: ten miles north of Red Bluff, 500 feet; Red Bluff, 300 feet; Bloody Island, 350 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet; Turner's, 3500 feet.

Weights of the ten largest males trapped at Red Bluff in May ranged from 35 to 66 grams (average 43.6). The heaviest male obtained, one from Bloody Island in May, weighed 74.3 grams. Weights of the nine heaviest males trapped at Dale's in May ranged from 37 to 72.5 grams (average 53.5). Four males from Lyman's, in June, weighed 54, 55, 63, and 71 grams. An April-trapped male at Turner's weighed 62.5 grams. The ten heaviest females, containing no embryos, ranged in weight from 43 to 58.5 grams (average 49.8).

Individuals of this kind of meadow mouse were most frequently trapped in sets of well defined runways beneath dense cover of vegetation. Many were caught on ground beneath the thickets which bordered the streams in the western part of the section. Since these animals were found living in drift masses on the river's bank, as some near Red Bluff were found doing, it is easy to account for the ascertained presence of meadow mice on an island, in the Sacramento River, which showed evidences of having been completely inundated at high water.

A few of these mice were taken in grassy places close to streams. Others were found beneath boards on the ground where the cover of vegetation was not dense. In the neighborhood of Manton numerous faint runways were seen in April in the sparse grass beneath thick clumps of scrub-oak, and, on several occasions, mice were observed to run through them in the daytime.

Two females at Dale's, June 1, and one at Lyman's, June 10, each contained four embryos.

On April 18, 1929, in the timber close to Paine's Creek just below Dale's, a log was turned over and a meadow mouse was seen beneath it. A nest there made of fine grasses was left empty. Runways in the soil ran the full length of the log. The mouse appeared to be dazed by the removal of the cover and, at first, it did not make any effort to escape.

That this rodent constitutes an important food source for certain raptorial birds is indicated by our analysis of the pellets of barn owls, gathered near Bloody Island. Out of a total of 126 individual mammals represented, 37 were *Microtus*.

The *californicus* type of meadow mouse as occurring within the Lassen section caused us much trouble when it came to determining subspecific status. As seen from the list of localities, our series represents populations from the immediate margins of the Sacramento River, from prairie grasslands west of the river, and from various places east of the river up the piedmont slope to as high as Turner's, 3500 feet altitude. Some appearances of local variation presented themselves at first inspection, suggesting the presence of more than one subspecies. But at length we find ourselves led to consider the entire series as falling into one subspecific category; and this category we find to approximate closest, of the defined forms, to *M. c. eximius*.

The difficulties met with are explicable upon reference to Kellogg's (1918) map, and his statements of characters and distribution; for the ranges of *eximius, aestuarinus,* and *mariposae* according to his definitions come together in the upper Sacramento Valley. The only material Kellogg had from this uncertain territory was from Mill Creek—five specimens taken in 1912 and included also in our present "section" series. These, Kellogg included under *aestuarinus,* in his list of specimens, as from the northernmost locality for this subspecies; but he did not use this locality in his formal statement of the range of the subspecies. Our examination leads us to exclude *aestuarinus* entirely from use for any of our specimens, even those from Mill Creek, the characters here depended upon being cranial as well as of coloration (none dark-colored as in *aestuarinus*). While placing the entire series under *eximius,* because of the mean gray coloration, medium size, and certain cranial characters, we note tendencies as to general size, reddish tinge of pelage in some examples, and some of the features of the skull, toward *mariposae.*

In other words, there is indication that *eximius* of the northern Coast Range region blends toward *mariposae* across the upper end of the Sacramento Valley and thence south along the eastern side to a completion of the blending somewhere south of our section. The Sacramento Valley does not carry *aestuarinus* so far north, as Kellogg implied in his map, as Tehama County.

Microtus mordax mordax (Merriam)

Cantankerous Meadow Mouse

We trapped this race of mouse at three localities near the northern boundary of the eastern part of the section (fig. 117), as follows: Butte Lake, 6100 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet.

A male trapped at Butte Lake in June weighed 28.7 grams. Weights of the ten largest males taken in late September and early October ranged from 22 to 41.6 grams (average 30.1). The ten largest females, none of them pregnant, weighed from 25 to 41.2 grams (average 28.6).

At Slate Creek and at the collecting station north of Fredonyer Peak, meadow mice were trapped beneath willows near a stream and in a meadow. In the meadow where sheep had trampled the ground, the mice occupied burrows among the roots of clumps of willows.

Our material from the three localities given above indicates beyond doubt that the *mordax* type of meadow mouse within our section breaks within a surprisingly short distance into a distinguishable northeastern form. This race is found to exhibit the characters of the wide-ranging Great Basin subspecies, *M. mordax mordax.* As compared with *M. mordax sierrae* from Warner Creek Valley and from west of Black Butte in the Mill Creek drainage, differences are shown as follows: Size (of *mordax*) small; the ten largest individuals out of 22 seemingly full-grown examples of *mordax* average: total length 165.3 mm., tail vertebrae 54, hind foot 21.7, ear from crown 10.7. The ten largest out of 30 examples of *sierrae* average: total length 186.6 mm., tail vertebrae 61.7, hind foot 22, ear from crown 11.2. Thus, the southwestern animals, on the basis of these figures, are 13 to 14 per cent larger than the northeastern ones. As to skulls, too, differences are manifest to the eye, quite as set forth by Kellogg (1922, pp. 284–292) in comparisons of *mordax* with *sierrae*. The coloration of our series of *mordax* is paler, more gray, than in *sierrae*. This new material of ours enables us thus to carry the known range of *M. mordax mordax* many miles southwestwardly from previously known stations (in the Warner Mountains, Modoc County).

Our one specimen from Butte Lake (no. 36866) is extreme in the characters of *mordax*, not showing, as might have been expected, any strong tendencies toward *sierrae*. This occurrence recalls the parallel trend in the fox sparrow group and in the conies. It is to be noted here that Butte Lake lies only ten miles northeast of Warner Creek (where *sierrae* is the subspecies of meadow mouse); but lava flows of more or less recent activity intervene.

Microtus mordax sierrae R. Kellogg

Sierra Nevada Meadow Mouse

Found by us southward from Lassen Peak, from two miles west of Black Butte eastward to the neighborhood of Kelly's (fig. 117). Specimens represent the following localities: two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet; Kelly's, 5200 feet.

Weights of the ten largest males, June, July, and September, ranged from 41.6 to 55.2 grams (average 47.0). The nine largest non-pregnant females trapped at the same times ranged in weight from 40 to 65.8 grams (average 48.8).

This kind of meadow mouse was trapped in a varied set of situations, some of which were described by the collectors as follows: in runway in grass beside creek; at edge of creek, no grass close by; under log near creek; under alders on muddy shore of small creek; in meadow where alders were growing; at entrance of ill-defined burrow going under dry splinter of log on bare, rocky slope at edge of snow-brush clump, 150 meters up steep hillside from edge of bog.

Individuals of this species tended to be less closely restricted to systems of runways than other kinds of meadow mouse found in the section. In other words, foraging may in this species extend more widely: the animals individually may be more venturesome.

Embryos were found in trapped females as follows: two miles west of Black Butte, June 24, 4, July 8, 5; Willow Lake, July 19, 3 and 4, July 24, 4; Kelly's, July 29, 5.

Ondatra zibethica mergens (Hollister)

Nevada Muskrat

Muskrats were present at Eagle Lake, where several were obtained near Spalding's. Also tracks were seen in mud around a pond near the head of Willow Creek. Weights of three males collected in October, 1923, were, in grams, 840, 880, and 1232.

A muskrat was seen at 5 p.m., June 15, 1929, swimming in the creek in Secret Valley one mile above Secret Valley Ranch. Persons living at the ranch said that this species was of frequent occurrence farther down on that creek.

This animal was found in 1923 to be living in burrows in the slough forming the mouth of Pine Creek where it enters Eagle Lake. The banks of the stream-course were of clay with alternating layers of sand. The dens were placed in the sand layers, usually beneath hard layers of clay. At this place there was deep water close to the shore. One den that was excavated extended 8 feet into the bank; the diameter of the burrow was 5 to 6 inches; there was a "hall-way" cavity in the course of the burrow that was 20 by 24 by 30 inches in dimensions; and the burrow terminated in a "den" of smaller size, sparsely floored with "nest material." The terminal den was well above the level of the water; but the two entrances to the burrow were below the water level (Dixon, MS).

Feeding rafts (fig. 171) where the muskrats were observed to go at dusk each evening to feed were found in the patches of cat-tail (*Typha*) and tule (*Scirpus*). These platforms were at locations too far distant from the shore to permit of carrying food there to be eaten. Most of the structures were small, less than one meter in diameter, but one that was seen in June, 1921, was five by six meters. On top of this large raft was a pile of chewed-up refuse. Apparently, the muskrats preferred as food the basal, white portions of the stems of *Scirpus*. On one occasion two individuals were seen feeding at one time on a raft.

No evidence of house-building was noted on the part of the muskrats in this territory.

With the continued lowering of the water in Eagle Lake, conditions became unfavorable for muskrats. Mr. S. A. Webb who lived at Spalding's told us that by 1929, this species had practically disappeared from that vicinity. He had caught three individuals, in Pine Creek, during three years of trapping.

Fig. 171. Raft of Nevada muskrat (*Ondatra zibethica mergens*) made of stems of rushes and serving as a temporary feeding place. Uneaten portions of aquatic plants accumulate and the rafts grow larger. Photograph taken June 23, 1921, at Eagle Lake. Mus. Vert. Zool. no. 3647.

Rattus rattus alexandrinus (Geoffroy-Saint-Hilaire and Audouin)

Roof Rat

Specimens obtained at four miles south of Red Bluff, 270 feet; Red Bluff, 300 feet; Mill Creek, 260 feet; Kelly's, 5200 feet. Near Red Bluff rats were trapped at the edge of the water of the river on the bare sand, in the basal parts of grapevine tangles, and among roots under an under-cut bank. At Mill Creek one was trapped within a thick blackberry-grape tangle. The one obtained at Kelly's was in a meat house.

A female killed at Red Bluff, May 5, 1924, contained five embryos. That individual weighed 154 grams. A young female trapped at Red Bluff, May 10, 1924, weighed 86 grams. An adult male from Red Bluff weighed 210 grams; one from Kelly's, 214.5.

Mus musculus Linnaeus

House Mouse

Trapped at: Red Bluff, 300 feet; Dale's, 600 feet; Manton, 2300 feet. Near Red Bluff, May 12, 1924, a male was trapped in a "runway" on the sandy ridge of an island in the Sacramento River, water on all sides, at the same place where a meadow mouse (*Microtus*) was obtained the day before. At Dale's one was trapped in a house, December 30. At Manton several individuals were captured in early June at the edge of a grain field.

An adult male from Red Bluff, trapped May 12, weighed 12.5 grams; the one caught in a house at Dale's weighed 20.6 grams.

Aplodontia rufa californica (Peters)

Sierra Nevada Mountain Beaver

At several localities in the section we talked with persons who were familiar with the appearance and habits of this animal. The years when our work was done in these localities were exceptionally dry ones, and this condition may have, at least in part, accounted for our failures to find the animals at places where previously other persons had seen them. Two such localities were: an upper branch of Antelope Creek, south of Lyman's and at about 3000 feet altitude; certain ravines south of Kelly's, 5200 to 6000 feet altitude.

One definite record of capture of a mountain beaver within the section has been published by Taylor (1918, p. 475), who examined a skin from "Lassen Peak, upper edge Canadian zone, east side."

In the summer of 1884, Townsend (1887, pp. 174–175) found "sewellels" "in several places on the eastern slopes of Mount Lassen," but so far as indicated by his published report and his manuscript notebook, he preserved no specimen. The only definite localities he mentions are "Morgan's Springs, on the headwaters of Mill Creek," and "Big Meadows, on the north fork of Feather River." In the latter place burrows were seen in "a wild gorge, deep and narrow, down which the little river dashed with roar and foam." Near the holes in the clayey banks were "scattered bunches of freshly cut weeds and coarse grasses. Some of the green herbs were dragged partially into the mouths of the burrows. . . .

Zapus pacificus alleni Elliot

Allen Jumping Mouse

Specimens represent the following localities: Battle Creek Meadows, 4800 feet; Summit Creek, 5200 feet; two miles west of Black Butte, 6800 feet; Warner Creek at 8000 feet; Drakesbad, 5500 feet; Willow Lake, 5600 feet. An individual that was not captured was seen at 7 p.m., July 15, in a small stream at Lake Helen, 8200 feet, where it was hopping in water twenty-five millimeters deep; thence it made off under alders.

Among the types of situation where this species was trapped are the following: edges of small streams, bottom of small wet ditch, "in tules," under alders, amid lupines and willows about springs, in a grass patch, under logs at edge of creek, and on side-hill in open place among firs twelve meters from stream.

Four June–July caught males weighed between 22.5 and 25.5 (average 23.6) grams. Weights of four September caught males averaged 24.8 (20 to 29.6) grams. Eight females caught in June and July weighed between 23.2 and 34 (average 26.8) grams. Six September caught females averaged 24.3 (20.3 to 30) grams in weight.

The latest fall date of capture of this species in the section is September 13, 1923, when three were trapped at Warner Creek at 8000 feet. None of these specimens showed any trace of incoming new pelage.

Erethizon epixanthum epixanthum Brandt

Yellow-haired Porcupine

Specimens were preserved from two miles west of Black Butte, 6800 feet, Petes Valley, 4500 feet, and Dransfield's, 5300 feet. Evidence which demonstrated unquestionable presence of porcupines was found at the following additional localities: western end of Battle Creek Meadows at 4800 feet; Mineral, 4900 feet; Summit Creek, 5200 feet; Warner Creek at 6600 feet; Butte Lake, 6100 feet; Slate Creek, 5700 feet; five miles north of Fredonyer Peak, 5700 feet; Termo, 5300 feet; seven miles south of Ravendale, 5400 feet; one mile west of Red Rock P. O., 5300 feet; Box Springs, 5300 feet. At Dale's, 600 feet, we were told that individuals of this species occasionally go as low as that place in winter and that during one winter dogs killed four there.

Townsend (1887, pp. 178ff) gives an extended account of porcupines as he found them, abundantly, in the summer of 1884 in western Lassen County. Their persistent gnawing of a stump salted for stock is particularly dwelt upon.

A female collected in January weighed 17½ pounds.

Porcupines were found associated, definitely, with red fir, white fir, willow, juniper, and sage-brush. Individuals were found out on dry meadows and often in or near outcrops of rocks or rock slides.

Late in the evening of January 7, 1926, at Dransfield's, a porcupine was seen curled up, apparently asleep, in the topmost branches of a juniper. The day was cold and the wind was strong, so that it seemed strange to find this animal in such an unprotected place. (See also fig. 172.)

Fig. 172. A young yellow-haired porcupine (*Erethizon epixanthum epixanthum*) just aroused from sleep on an exposed horizontal limb of a juniper. This animal's relative freedom from disturbance by predators gives it a wide choice of kinds of resting situations. Photograph taken October 2, 1924, five miles north of Fredonyer Peak. Mus. Vert. Zool. no. 4510.

A young porcupine was watched walking among the rocks at the edge of Petes Valley in the morning of July 13, 1928. All the movements of the animal were slow. As it advanced, its tail dragged over the ground. It coughed several times, and a few soft, whining whistles were heard. When the animal caught sight of the observer standing nearby, it elevated the tips of its quills and turned with its tail toward the observer in order better to ward off a possible attack. Finally the porcupine crawled beneath a large rock where it remained.

A method of escaping capture used by this species was to clamber up the trunk of the nearest tree.

In the evening of September 30, 1924, at five miles north of Fredonyer Peak, a half-grown porcupine was seen up in a clump of willow saplings. The animal was hanging on to the limbs with three feet and pulling the near-by twigs toward it with the fourth. From the tips of these twigs it ate the tender leaves. On several occasions porcupines were seen on the ground feeding on grass. In one case the animal was nipping off dry stubs of short grass.

A single individual was seen, seven miles south of Ravendale, June 17, 1929, foraging on the ground among bushes. The animal was eating the small herbaceous plants (several species), flower, stem, leaves—all parts down to the ground.

In a tract of trees bordering the west end of Battle Creek Meadows, there were aspens, lodgepole pines, white firs, and yellow pines, successively up the gentle slope from the level of the meadow. However, at this place, in May, only the young firs showed the work of porcupines. The white, peeled, terminal spires of many of these small firs, worked upon evidently during the winter preceding, showed forth conspicuously, as did also, in places, the dying top foliage of those firs that had been girdled below their summits. Close by, in a broken-lava outcrop, were the headquarters of at least one of the animals, as announced by the penetrating and characteristic odor. Among the rocks were accumulations of old and some fresh feces; also great numbers of quills, scattered beneath rock edges as if scraped off during the passage of the animals back and forth.

A female collected January 7, 1926, at Dransfield's, contained a single embryo 100 millimeters long.

An old female porcupine with a half-grown young one was discovered in the evening of July 5, 1924, at the edge of a field near Box Springs. Attention was directed to the animals by hearing moaning sounds, and a close approach was made behind a fence. The voice of the young animal was much weaker than that of the mother. The two were playing. The young one would clamber up the trunk of a sage-bush. Then it would back down, run over to, and, standing on its hind legs, attempt to climb onto the head of the adult. The two would then roll over and over on the ground. The quills of the mother appeared not to deter the climbing of the young one. When nursing the young one, the mother stood on her haunches and the little one stood on all four feet directly in front of her. All the movements of both animals were grotesquely slow (Dixon, MS).

Ochotona schisticeps schisticeps (Merriam)

Gray-headed Cony

Generally distributed through the higher portions of the section down to as low as 4800 feet on the west and 5300 feet on the east (fig. 118). Specimens preserved from the following localities: Battle Creek Meadows (west end), 4800 feet; Martin Creek at 7500 feet; two miles west of Black Butte, 6800 feet; near Lake Helen, 8200 feet; Warner Creek at 8000 feet; Warner Creek at 6600 feet; Kelly's, 5200 feet; Butte Lake, 6100 feet; Gallatin's, 5200 feet. Also observed, but not collected, at: Summit Creek at 5200 feet; Lassen Peak at 9500 feet; Prospect Peak, 7000 to 7500 feet; Eagle Lake Resort, 5200 feet.

Eight miles southwest of Ravendale, July 18, 1928, a cony was heard in a small rock slide near the top of a southwest-facing slope at 6400 feet. Excreta of conies and accumulations of food materials were seen among the rocks. This place is practically halfway between stations where specimens representing this race and the race *taylori* have been collected. The subspecific status of this colony remains in doubt.

Townsend (1887, p. 180) gives an interesting account of his experiences with conies "in the vicinity of Morgan's Springs" in the summer of 1884. This account accords accurately with our findings forty-odd years later.

Weights of five apparently adult males collected in June at Butte Lake are, in grams: 141, 145.7, 151.3, 151.6, 161 (average, 150.1). Five adult females, in which no embryos were found, taken at the same time, weighed: 169.1, 172.4, 177.7, 188.8, 238.7 (average, 189.3) grams. Five adult males that were taken on Warner Creek in September weighed: 126.9, 130.1, 131, 136, 155.5 (average 135.9) grams. Four adult females of same data weighed: 128.2, 132.1, 140, 150 (average, 132.5) grams. An adult male taken at Battle Creek Meadows in May weighed 170 grams; another taken at the same place June 12 weighed 149.5 grams. These weights indicate that, possibly, there is a decrease in weight in individual animals through the summer and that this decrease in weight is most marked in the females. It would be expected that the animals from Butte Lake would weigh less, at the same season, than the ones from Warner Creek, since in other characters they appear to approach the race *taylori* which is definitely smaller than *schisticeps* as is shown by comparing weights of series of both taken at the same season.

At Battle Creek Meadows, 4800 feet, the westernmost as well as lowest station of ascertained occurrence of conies within the section, one was shot while it was perched on a rotting slab of wood among broken rocks (fig. 78) only fifty feet above the level of the lower end of the meadows. Back from the meadow edge, up toward Turner Mountain, are several sloping areas of much-broken lava rock, so extensive as to be visible, conspicuously set off from the surrounding woods, from the opposite side of the valley. Conies were found commonly in the lowermost of these large "slides." A Douglas ground squirrel was seen at the same time and within a few feet of the place where the above-mentioned specimen was taken (Grinnell, MS).

Conies were heard and one was collected in a talus slope at 7000 to 7500 feet along the cañon walls at one of the heads of Martin Creek. The rocks here were up to a meter or more in diameter. Out from the talus were mats of *Arctostaphylos nevadensis*, chinquapin (upper limit and dwarfed) and *Ceanothus velutinus* (upper limit). Near-by trees were red fir, lodgepole pine, silver pine (upper limit), and mountain hemlock (lower limit).

Two miles west of Black Butte, conies were found to be living commonly in the rock slides at the base of a cliff. Here, on July 8, 1924, one was trapped at least 100 meters from the nearest rock slide, under a big rotten log in dark woods. The animal, a female juvenal weighing 68.5 grams, was found dead beside a sprung mousetrap, having been hit on the head (Hunt, MS).

The highest ascertained station of occurrence of the cony in our section is near timber-line, at 9500 feet, on the south side of Lassen Peak, where one was heard in the loose rocks of the talus on August 1, 1925.

In addition to the conies that were found in the usual type of rock slide near Warner Creek at 8000 feet (figs. 75 and 76), one individual was found which had established its home in a less usual type of situation. This animal had a haypile more than a meter in diameter and 15 centimeters thick under a large boulder (7 by 7 by 3 meters) that lay on a hillside surrounded by a few scattered small rocks (fig. 173). This individual was observed for more than a week. Then it was shot, on September 15, 1923, and proved to be a female. No other individual was ever seen within 75 or 80 meters of this particular boulder. This animal appeared each morning at about eight o'clock, or twenty or thirty minutes after the sunshine first struck the boulder under which it lived; and it continued quite active until about ten o'clock, making short foraging trips of from two to seven meters away (Dixon, MS).

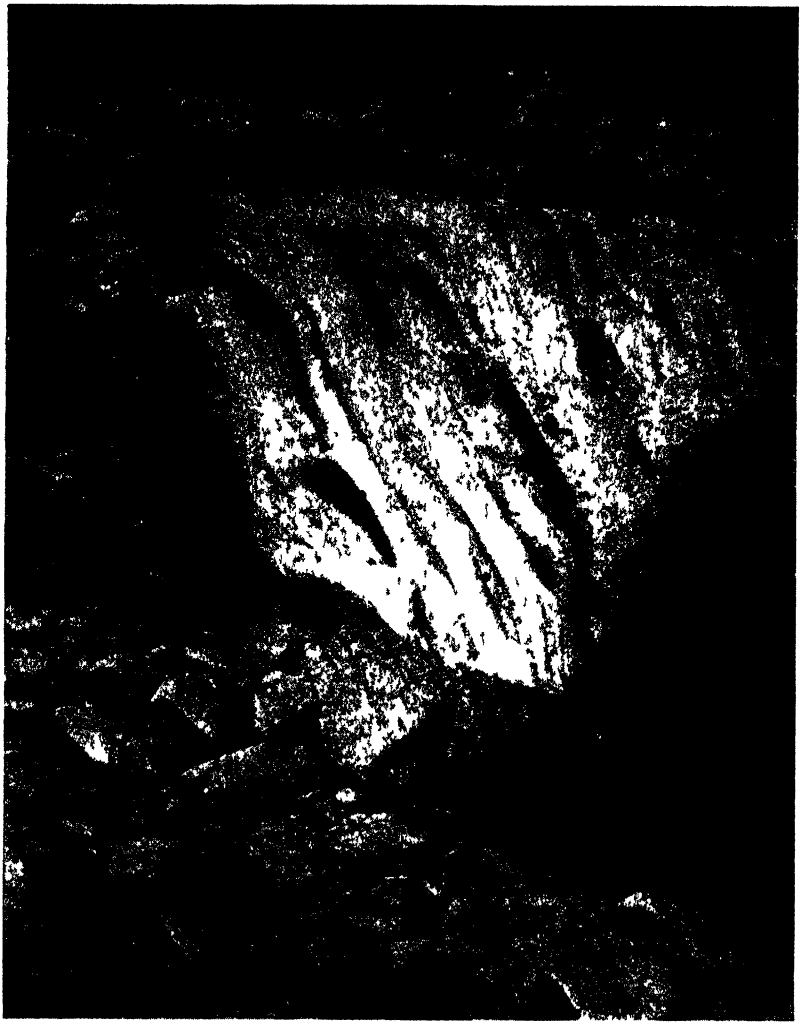


Fig. 173. Site of the home of a gray-headed cony (*Ochotona schisticeps schisticeps*) beneath a single large boulder surrounded by scattered small rocks (see p. 535). Photograph taken September 12, 1923, near Warner Creek at 8500 feet. Mus. Vert. Zool. no. 4240.

At 6600 feet on Warner Creek there is an extensive rock slide on the south side of the creek in which, between September 18 and 29, 1923, conies were found in some numbers. One individual whose appearance was timed for four mornings always came out between 8 and 8:10 o'clock. Ordinarily the conies had retired for the night by 5 o'clock, although one was shot at 5:30, dusk. On September 22. there was snow and no conies were seen. By September 29, although the snow remained, the conies began to come out again. They seemed careful to keep on the dull-colored rocks and off the snow. They were conspicuous when on the snow, but scarcely visible when on the rocks (Dixon, MS).

In the vicinity of Butte Lake conies were found commonly the third week of June, 1926, in the edge of the ridge of broken lava between the cinder cone and the lake (fig. 77). Not one was seen more than 10 meters from the edge of the rocks. Others were found among the rocks in slides on slopes north of the lake. These rocks were lighter in color and were broken into larger pieces than the lava on the opposite side of the lake (Linsdale, MS).

Near Gallatin's on the southeast shore of Eagle Lake, on May 30, 1925, conies were found in a rock slide which faced the south and was dry and hot, and surrounded by mountain mahogany. Two days earlier one was heard as low as 5200 feet. One was heard at a slide at 5800 feet on the same ridge. This latter was in a large talus slope with a fine meadow and a spring with a fringe of aspens at the base of the slide.

Conies observed for a period of several days in September were seen to spend a considerable amount of time sitting still in the sunshine, usually on the tops of rocks in situations protected from the wind. A marked curiosity as to happenings near their homes was shown by certain individuals. One cony in particular would almost always appear within a minute if a person walked over the loose stones near by and then stopped to watch quietly. The appearance was nearly always on the side of the home whence the last noise had come. At first only the nose of the animal could be seen; then, if there was no quick movement on the part of the observer, the ears and head of the cony would appear; and finally the whole body could be seen. However, if the cony saw the intruder move, it would quickly disappear (Dixon, MS). (See figs. 174 and 175.)

One carefully written description of the note of the cony, as taken down in the field, is as follows: "A reasonable spelling of the note would be *kaek-kaek-kaek* (usually uttered three times in succession, but sometimes twice). This spelling does not recognize, however, two elements inherent in the utterance—a scrapy, German-*ch* sound, and a squealing sound. The scrapy element is outstanding at a distance; the squealing element comes into prominence as one draws close to the animal. A more complete spelling, that includes these elements, would be

$$\overset{\frown}{ch}aelk\text{-}\overset{\frown}{ch}aelk\text{-}\overset{\frown}{ch}aelk, \text{ or } \begin{array}{ccc} \overset{\frown}{ch} & & \overset{\frown}{ch} \\ l & & l \\ k & ae & k \end{array} — \begin{array}{ccc} \overset{\frown}{ch} & & \overset{\frown}{ch} \\ l & & l \\ k & ae & k \end{array} — \begin{array}{ccc} \overset{\frown}{ch} & & \overset{\frown}{ch} \\ l & & l \\ k & ae & k \end{array}\text{''}$$

(Hunt, MS).

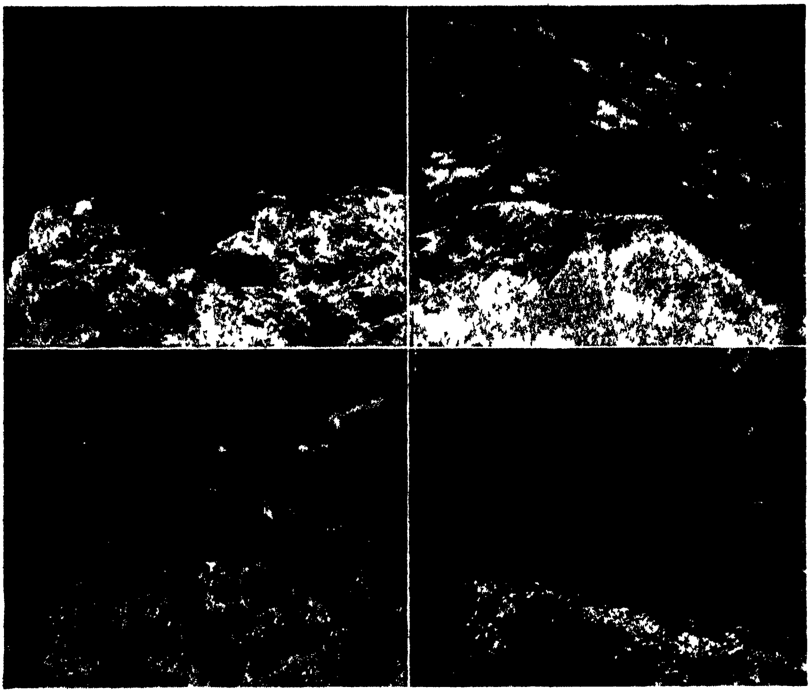


Fig. 174. Four characteristic poses of gray-headed cony (*Ochotona schisticeps schisticeps*), showing form of body and positions taken when the animals are out on exposed places on rocks. Photographs taken in September, 1923, on Warner Creek at 6600 and 8500 feet altitude. Mus. Vert. Zool. nos. 4241, 2, 4, 6.

Three conies were watched for more than an hour near Warner Creek at 6600 feet on the morning of September 19, 1923. One individual, instead of uttering its cry once or twice when a person approached, would repeat it a dozen times in quick succession "like an alarm clock." Instead of the other conies "ducking" when they heard the cry they all crawled hastily to some protected vantage point and there peered all about for the cause of the disturbance.

One habit of the conies that was noted often enough to make it appear to be firmly established was the tendency to "freeze" in the position in which the cry ended and to hold this position rigidly for several (5 to 10) seconds. In this position the animal has its head stretched out and the ears back by the nape of the neck. It seems possible that this habit might serve successfully in avoiding detection by a potential enemy. That is, if an enemy should look in the direction of the noise, there would be no motion to betray the cony's presence. This, together with the repeated observation that the animals "edge out," when coming into the open, so slowly as often completely to escape detection, suggests that this capacity for self-effacement on the part of the cony might be an important factor for safety in the long-time experience of the species (Dixon, MS).

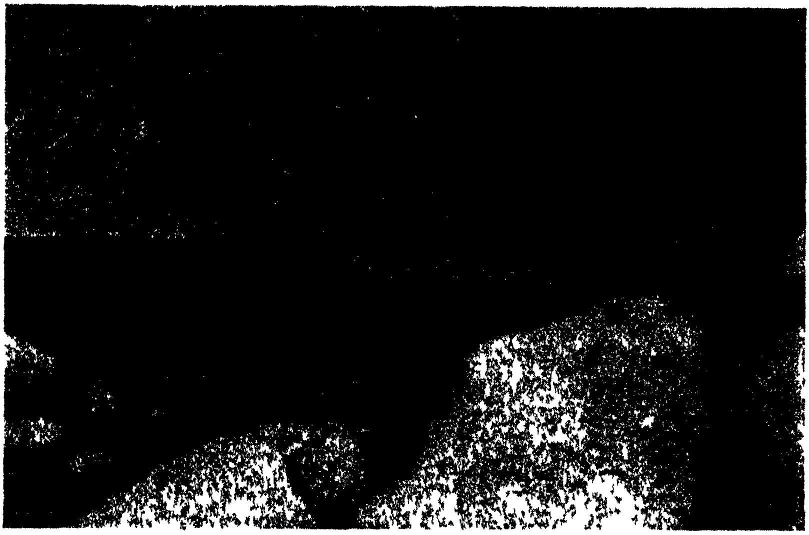


Fig. 175. Accumulated feces of gray headed cony (*Ochotona schisticeps schisticeps*) in natural position on rocks close to food store. Photograph taken September 15, 1923, near Warner Creek at 8300 feet. Mus. Vert. Zool. no. 4236.

Conies may sometimes store food materials early in the summer. At the edges of the lava bed at Butte Lake, in mid-June, 1926, individuals had piled under the rocks the drying leaves of a sedge (*Carex*) that was growing near-by and, at a few places, the tips of branches of a bush (*Ribes*) that was growing within ten meters. However, food is not always carried to the protection of rocks or to a storage place before it is eaten, for elsewhere, near Warner Creek at 8000 feet on September 13, 1923, two individuals were seen nibbling grass out in the open.

On September 12 and 15, 1923, near Warner Creek at 8000 feet, the afternoon sky was overcast and conies were busy harvesting their "hay." They proceeded with their work while being watched at a distance of thirty meters. One cony that was later shot (proving to be a female) made regular trips, taking from one to three minutes for a round trip, to a bush forty meters distant from its headquarters. It had two regular stopping or outpost stations on the way and stopped at these, both going and coming, to listen. Upon reaching the harvest bush the animal went under it and stood upright on its hind legs and reached up as high as it could, with its forepaws resting on a green branch which was usually about the diameter of a match. These twigs were cut into 150 to 250 millimeter lengths and were carried crossways in the mouth of the animal to the hay pile.

Fig. 176. Haypile built by gray-headed cony (*Ochotona schisticeps schisticeps*). Compare type of materials as seen here with that shown in figure 177. Apparently, availability largely determines what kinds of vegetation are stored. Photograph taken September 15, 1923, near Warner Creek at 8300 feet. Mus. Vert. Zool. no. 4237.

The cony mentioned in the paragraph above covered thirty meters of rocky hillside, carrying a mouthful of forage, in from ten to fifteen seconds. It ran or rather hopped from rock to rock, for the most part hitting only the high places. At certain times, especially if danger threatened, the animal would run under or beside an overhanging rock, much as would a wood rat. Distances covered at a hop varied from 2.5 to 75 centimeters, with 25 as an average when at full stride (Dixon, MS).

The haypile (fig. 176) in this case was found to consist of sedge (*Carex*), about one-half; of prostrate manzanita (*Arctostaphylos*), one-fourth; and of ocean spray (*Holodiscus discolor*), one-fourth. There were several leaves and branchlets of chinquapin (*Castanopsis*) in the pile. Mixed in among the leaves of green vegetation were layers of dead twigs, apparently serving as blotters to assist in ventilating and curing the "hay." These dead twigs were not to be eaten, since in old haypiles they are found cast out with feces and other refuse.

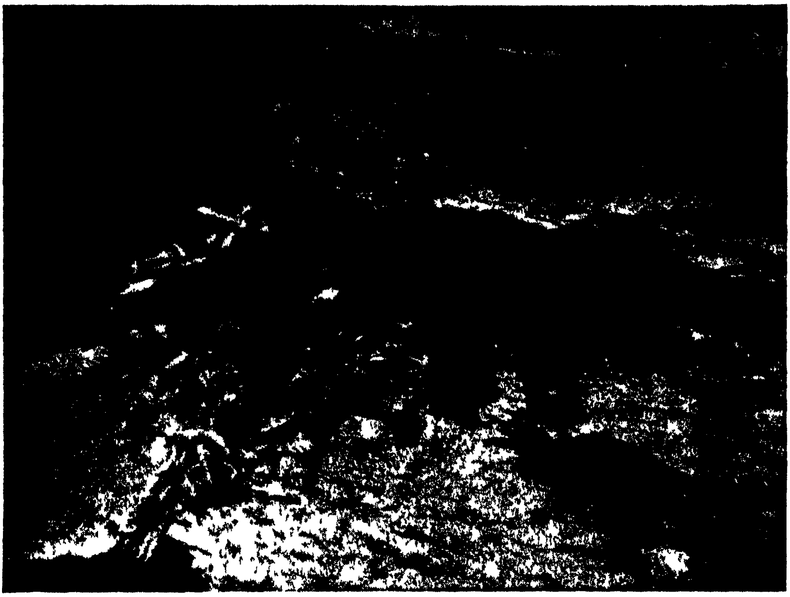


Fig. 177. Haypile of gray-headed cony (*Ochotona schisticeps schisticeps*) in undisturbed position. Constituents of this store were taken to the museum and analyzed (see p. 542). Photograph taken September 27, 1923, near Warner Creek at 6600 feet. Mus. Vert. Zool. no. 4239.

Close watch was kept of a cony as it collected its haypile on Warner Creek at 6600 feet altitude, between September 19 and 29, 1923. In this instance a special effort was made to determine whether two or more conies worked together to build up the same hay pile. However, observations made repeatedly during the daytime indicated that the haypile in question was entirely the work of one individual.

This cony made regular foraging excursions down the slope to a thicket of Labrador tea and red fir seedlings which grew on a damp hillside just below the rock slide where the animal lived. The observer found that this particular cony did not take the plants that grew nearest its home but, rather, showed decided preference for certain kinds of forage which grew as far as 25 meters from its home. In other words, the cony did not go out and gather just whatever green vegetation was nearest. As illustrative of this fastidiousness, chinquapin which was being gathered in quantity by conies elsewhere in the region was avoided altogether in this instance. Willow and elderberry, which were being cut by bushy-tailed wood rats that lived in the rock slides with the conies, were left undisturbed by the latter.

Two species of woolly weeds, hawkweed and a white everlasting, that grew sparingly amid the rocks of the talus slope, were much sought by the cony, which was observed to venture the maximum forage distance in order to obtain them. In securing the winter's food the cony apparently did not attempt to exhaust the supply of one kind of plant, but, rather, gathered a load of first one and then another species. This tendency to "sandwich" the material into the haypile is well illustrated by figure 177.

Few or no data have been published regarding the *relative amounts* of the various kinds of food stored by conies. Therefore this haypile, which is believed to represent the work of one cony during a period of one month, was preserved together with the cony that made it. Composition, by weight, of this cony's haypile was, when air-dry and thoroughly cured, as follows:

	GRAMS
Labrador Tea (*Ledum glandulosum*)	677
Red Fir (*Abies magnifica*)	335
White Everlasting (*Gnaphalium microcephalum*)	240
Hawkweed (*Hieracium horridum*)	140
Rotten wood (accidental, not food)	135
Sedge (*Carex* sp.)	80
Red Heather (*Phyllodoce breweri*)	47
Mountain Hemlock (*Tsuga mertensiana*)	40
Pine-mat Manzanita (*Arctostaphylos nevadensis*)	19
Usnea Moss (*Usnea*)	8
Silver Pine (*Pinus monticola*) and Pine Mistletoe (*Arceuthobium campylopodum*)	3
Lodgepole Pine (*Pinus murrayana*)	1
Golden Rod (*Solidago* sp.)	1
Unassorted materials	48
Total, grams	1,774

A female cony (no. 35279) that was collected at Gallatin's on May 30, 1925, contained three embryos each forty millimeters long. The three embryos, together, weighed eleven grams, and the total weight of the mother was 159 grams.

A female collected at 7000 feet near Martin Creek, June 8, 1928, contained three embryos. This adult was exceptionally fat and weighed 165 grams. At Butte Lake on June 15 and 16, 1926, two females containing three and two large embryos, respectively, were taken. Another female containing two embryos was collected two miles west of Black Butte, July 1, 1924. It would appear likely from the above data that, in this region, the litter is of small size, 2 or 3, so that despite the seeming helplessness of the cony the individual safety it enjoys may be inferred to be greater than that of either the cottontail or jack rabbits. The cony's timidity—close adherence to protective cover—figures here.

Whether or not more than one litter is reared in one season by any given female is not clear from the data we have. A young animal captured on June 14 weighed 49.4 grams; a young one of date September 13 weighed 106.4 grams—still far from full grown. Much variation in dates of birth is indicated. Also, the fact of precocity is shown: youngsters scarcely one-third grown are already venturing forth from their breeding refuges.

Ochotona schisticeps taylori Grinnell

Warner Mountains Cony

One specimen from the vicinity of Termo, 5600 feet, taken October 10, 1924, represents the only ascertained occurrence of this race within the section. This and other individuals were in a broken-up lava tract (fig. 74) on the first foothill of the southwest side of McDonald Peak. The ground surrounding this area of loose rocks seemed to be fully as dry as the surrounding hills and plains. The only trees in the vicinity were junipers. Some dried stems of bunch grass were found among the rocks where they had been placed by the conies. The specimen obtained was a female. This represents the southernmost station of occurrence so far recorded for this race of cony (see Howell, 1924, p. 40).

The specimen in question (no. 35242) presents the small size of *taylori,* but it is scarcely typical of that race in coloration. The color on the head more nearly approaches that of several in the series of *schisticeps* from Butte Lake than it does the average of a series of *taylori* from the Warner Mountains, Modoc County, California. As would be expected on geographic grounds, this example might thus be considered an intermediate between *schisticeps* and *taylori*; in any case, it seems to us nearer *taylori.*

Lepus townsendii townsendii Bachman

Western White-tailed Jack Rabbit

People who are resident in the region to the north of Eagle Lake report that this jack rabbit comes to that vicinity from the higher ground to the west during the winters when there is deep snow. The only definite record at hand of occurrence of this species within the section is of a single individual that was seen among some snow-brush near Willow Lake, 5600 feet, on July 23, 1924. A resident of the region said that he killed one of these animals seven miles west of Termo in the winter of 1925, and that he had seen two or three others there at different times.

Lepus washingtonii klamathensis Merriam

Oregon Snowshoe Rabbit

Seemingly limited to the forested portions of the section, and to altitudes between 4800 and 6600 feet. Specimens collected at the following stations: Mineral, 4900 feet; Summit Creek, 5200 feet; Willow Lake, 5600 feet. Individuals observed also at Battle Creek Meadows, 4800 feet; Warner Creek at 6600 feet; Kelly's, 5200 feet.

Snowshoe rabbits were encountered, though not frequently, among snow-brush thickets and small firs and in or near thickets of alders or willows in meadows. In the vicinity of Mineral, in December, 1927, where field work was done six days after a snowfall, tracks of this species were found to be plentiful. These tracks were more numerous under and near the willow and snow-brush thickets and clumps of small conifers than on the near-by and more open ridges. The impression left of this species, is that it is less diurnal in activity than the other kinds of rabbits except, perhaps, the white-tailed jack rabbit.

Late in the afternoon of June 4, 1925, when an observer was seated at the edge of a dry meadow, a snowshoe rabbit hopped out from a clump of snow-brush thirty meters distant and sniffed about in the grass. The slight noise of a breaking twig caused the rabbit instantly to shift its large ears, evidently in an attempt to catch more of the disturbing sounds. This evidence supports the idea that in this species the ears are more useful than the eyes in detecting an approaching danger (Dixon, MS).

A female that was trapped in an open place among firs at Summit Creek on June 22, 1924, contained five large embryos. Another female containing five embryos was shot at Willow Lake on July 22, 1924.

A rather small young snowshoe rabbit was found dead in a trail through alders near Willow Lake in the third week of July, 1924.

Early in the afternoon of July 7, 1925, a young rabbit which weighed only 132.5 grams was stepped on by accident in an open place in the meadow near Mineral. The animal was alone in a small opening in the dense grass which here was about six inches tall. Clumps of willow and white alder were within twenty-five feet of the spot; and a little farther, on either hand, were lodgepole pines and aspens fringing the deeper woods beyond. The rabbit was evidently crouching out in the open meadow, even though the brilliant sunshine was beating down, rather than enjoying the shade beneath the better cover near-by. It is possible that others of the litter were in similar, scattered locations and that such an arrangement is adopted as a safety measure in the best interests of the entire litter (H. W. Grinnell, MS).

Still another juvenile, weighing 320 grams, was trapped in chaparral-bordering firs at Summit Creek, June 19, 1924. The two adult females, each pregnant, weighed 1135 and 1553 grams, respectively.

The record by Townsend (1887, p. 181) of a specimen, saved as "skin in alcohol," from "Tehama County," assumably Red Bluff, is to be doubted, as also his general statement that the species was "not uncommon in the upper Sacramento Valley." As for the specimen, it might have been brought to him from the mountains to the eastward or westward. All our later evidence shows this rabbit to be strictly Boreal in occurrence.

Lepus californicus californicus Gray

California Jack Rabbit

Occurs plentifully and widely on the western slope of the section below the 3500-foot contour, where present throughout the year. In summer, ranges upward and eastward to as far at least as Mineral, 4900 feet (fig. 110). Specimens were preserved from the following localities: Red Bluff, 300 feet; Dale's, 600 feet; Inskip Hill at 1800 feet; Lyman's, 3300 feet; Turner's, 3500 feet; Battle Creek Meadows, 4800 feet (June 18, 1925). Occurrence established by observation on Bloody Island, 350 feet; at Mill Creek, 260 feet; Inskip Hill at 3000 feet; Manton, 2300 feet; Mineral, 4900 feet (summer only).

This rabbit was found to be conspicuously present in many types of situation. In the vicinity of the Sacramento River it was seen under blue oaks, in dry pastures, on sandy patches of waste ground, and on gravel patches at the edge of the water. At Mill Creek some were seen on the open plain, and trails were to be seen through needle grass and foxtail. Near Dale's, jack rabbits were found under valley oaks and on the dry hillsides among scattering bushes of buck-brush. In the midwinter of 1924, at this place, tracks were seen on the snow. At Manton, jack rabbits were numerous on the brushy digger pine land.

East of about the 3000-foot contour and throughout the Battle Creek Meadows territory, California jack rabbits were seen in varying numbers each year, but in summer only. In winter over the same ground none was seen by us, not even a track; and this was corroborated by Mr. Ted Wells and other persons who remain in or travel through this country at that season. Mr. Wells declares, and everything we learned supports his statement, that these rabbits "migrate" up from the blue oak belt to the westward as the snow leaves, to return in the fall much as the deer, coyotes, and mountain quail do; only rabbits do not go so far east. Of course, with the rabbits it is only a sort of overflow movement participated in by but a relatively small part of the total population of the lower country—an advantage, likely, in that a widened summer range is attained, at a season, too, when conditions of drought and reduced food supply come on in the lowlands.

Mr. Coyle Turner told us that in the neighborhood of his ranch, at 3500 feet, south of the Lassen Highway and well within the yellow pines, jack rabbits remain through the winter.

The jack rabbits that were encountered in summer around Mineral were seen regularly at different points where the woods adjoin the margin of the big Battle Creek Meadows. When jumped, individuals would make off into the more open stands of timber. Now and then one would be met with back in the yellow pine woods, as along the Viola Road up to as high as about 5300 feet, west of Mineral. Within one mile east of Mineral, during June and July, several individuals held to regular forage beats on the nearly level ground among scattering tracts of snow-brush. Indeed, in 1925, on June 19 and other days, partly grown young jacks, as well as adults, were seen here; and this would seem to show that at this extreme eastern limit of the summer range of this race, breeding takes place. The young seen could not, it was thought, have traveled the ten miles or more of distance east from the nearest all-year habitat of the species.

Weights were taken of 19 supposedly full-grown jack rabbits, shot chiefly in the vicinity of Dale's. The average of all these weights is 2402 grams (5.5 pounds); 7 females averaged 2407 (1824–3088), and

12 males averaged 2399 (1982–2823). This race, *californicus,* is the largest of the "black-tailed" series of subspecies in California.

Our series of 25 specimens preserved from the western part of the Lassen section illustrates the *tendency* toward ruddiness of coloration pertaining to the jack rabbits of the upper Sacramento Valley in comparison with those from the central coast district of California, quite as pointed out by Nelson (1909, p. 131). This tendency has been used to justify the bestowal of a separate name on the Sacramento Valley animals—*Lepus californicus vigilax* Dice (1926, p. 11), type from Ball's Ferry, Shasta County, just north of our section. In view of the considerable range in individual as distinguished from seasonal variation in color tones and the consequent difficulty of separating many individuals in the combined series without reference to their localities, we are inclined to hold to Nelson's method of indicating the facts—by using the name *californicus* subspecifically for all of them. The name *vigilax* we would thus relegate to the synonymy of *californicus.*

Individuals exhibiting in extremest depth the ruddy tone, especially of the lower surface, referred to above are those of midwinter, not long after completion of the annual molt and before sunlight of much intensity has had its fading effect. The reddish and buffy tones are of fugitive character and evidently go fastest in localities where the animals are exposed most to bright sunlight. For example, an adult (no. 34928) of date June 14 from Lyman's, in the yellow pine belt, is still decidedly ruddy; in May examples from Dale's and Red Bluff the colors are gray-toned.

This factor, of differential fugitiveness of the reddish cast, which characterizes, grantedly though weakly, average Sacramento Valley jack rabbits in fresh fall pelage, makes still further difficult the identification of many individual specimens—in lack of any other ascribed character than color tone.

During April, 1928, jack rabbits were observed frequently in the daytime in the woods on the blue-oak-covered hills north of Red Bluff. Observation that month on the prairie and rocky plains showed a much smaller number of individuals there than among the blue oaks. Several that were seen in the daytime appeared to be acting normally and unaware of the presence of an observer. On the morning of April 5 one came over a ridge and, hopping leisurely, left again after making a circuitous route. Within less than a minute, one, apparently another individual, came in sight and took almost the same route. This rabbit appeared to sniff at the ground as if following a scent.

One rabbit that was watched stood up on its haunches and rapidly moved its forelegs up and down so that they hit one another, possibly to free the feet from some adhering object.

At mid-day on April 8 a rabbit, moving through the woods, came to within thirty meters of an observer and stopped in the shade of an oak. After a minute it lay down on its side with the hind legs partly folded. Then it rested its head on the ground and finally placed its ears flat along its back. This position was held for three or four minutes, when the animal roused itself, scratched the base of one ear with a hind foot and moved on, still leisurely. There was no cover of any sort, the vegetation all being under five centimeters high except the single tree which furnished the shade. The animals on the oak-covered hills seemed to move about much more freely in the daytime than did those individuals which lived on the open plains (Linsdale, MS).

The seeming reliance with which these rabbits depend upon hearing rather than sight was demonstrated by one observation near Cone's. A ground squirrel that was farther away from the observer than the rabbit gave an alarm note. The rabbit kept shifting and turning its ears, evidently "listening" in the direction of the squirrel, but appeared never to suspect the presence of a person although the observer stood in plain view.

Many jack rabbits were found occupying the same chaparral-covered slopes near Manton that brush rabbits occupied. However, the jacks kept to the more open places and when one was disturbed it would go thrashing away with a great commotion, in contrast with which the brush rabbits slipped away with scarcely a sound. Invariably, the species could be determined by hearing the animal run.

A jack rabbit was watched as it fed on low herbaceous plants in mid-afternoon of April 11, 1928. It was stretched out with body next to the ground and it "hitched" along slowly, not jumping, but rather creeping. Most of the individuals seen feeding in April near Red Bluff were eating alfilaria, which at that time thickly covered the hills

At Manton in mid-April, 1928, more young than adult jack rabbits were seen. Most of the young were slightly larger than full-grown brush rabbits. A very small young one, only a few days old, was seen at the edge of a scrub oak thicket on April 20. This young rabbit seemed to be dying, but no sign of injury could be distinguished (Linsdale, MS).

Lepus californicus wallawalla Merriam

Washington Jack Rabbit

Presence in the northeastern portion of the section (fig. 110) attested by specimens from: Termo, 5300 feet; Dransfield's, 5300 feet; Box Springs, 5300 feet. Observed also at: north end of Eagle Lake, 5200 feet; Petes Valley, 4500 feet; eight miles southwest of Ravendale, 5600 feet; Red Rock P. O., 5300 feet. Two females that were collected at Dransfield's on January 8, 1926, weighed 1787 and 2973 grams, respectively, and two males weighed 2287 and 2327 grams.

The jack rabbit race *wallawalla,* of sage-brush tone of color, is a characteristic mammal of the Madeline Plains, and it has been reported to occur pretty generally west to Eagle Lake. There is a broad hiatus between the extreme western border of the range of this race and the eastern edge of the range of dry-grass colored *californicus.* The two races are strikingly different in color tone, and our material affords no indication that interbreeding in this section ever takes place; no specimens of intermediate characters are forthcoming.

This jack rabbit was found on valley floors among growths of sage-brush, rabbit brush, and wild rye (*Elymus condensatus*). Near Red Rock P. O. in late July, 1928, many, chiefly young, were seen among clumps of vegetation. At mid-day they hid or rested in "forms" in the centers or on the north sides of the clumps. When disturbed, one would run, slow and stiff-legged, a few yards and stop, seemingly loathe to exert itself in the heat. Early in the mornings and late in the evenings the animals after being jumped would run much faster and would go farther than would the ones jumped at mid-day.

In the summer of 1928 the remains of many dead rabbits were seen in Madeline Plains vicinity. All people living in the neighborhood, and who were questioned, knew that the rabbits had been dying for some time but none knew the nature of the disease that seemed to be killing them. One man had observed that the greatest proportion of the rabbits had died in those places where there was a restricted food supply.

In certain years the jack rabbits are exceedingly numerous east from the vicinity of Ravendale; and in such years, when there is also coincidence, of good market demand, large numbers are shot and shipped to San Francisco. In the autumn of 1925, it was reported that 150 to 300 sacks, each containing two dozen rabbits, were delivered to the railroad station each week. The price realized was from $3.00 to $3.50 per dozen. The hunting was done chiefly by men armed with .22 rifles from wagons driven through the sage-brush (Borell, MS). Many also were caught in wire snares set in the conspicuous trails of the rabbits.

In Petes Valley in early June, 1929, great numbers of young of varied sizes were seen in contrast with small numbers of adults. The species, however, was not especially numerous.

Sylvilagus nuttallii nuttallii (Bachman)

Washington Cottontail

Found in the section from the vicinity of Eagle Lake eastward. Specimens preserved from the following localities: Spalding's, 5200 feet; Slate Creek, 5700 feet; five miles north Fredonyer Peak, 5700 feet; Petes Valley, 4500 feet; Termo, 5300 feet; Dransfield's, 5300 feet; Red Rock P. O., 5300 feet. Also observed at eight miles southwest of Ravendale, 5600 feet.

The majority of the cottontail rabbits of this species that were seen were in thickets of sage-brush. Usually, however, they were close to rocky outcrops or rock slides to which they ran for safety when disturbed. Some individuals were seen actually to hop from rock to rock. A few individuals were seen away from rocks, one of them out in a field that had been cultivated. Along Slate Creek some individuals were seen in the rim-rock at the edge of the valley. One near Termo was started from a brush pile.

An adult female shot near Red Rock P. O., July 23, 1928, weighed 428 grams. A nearly grown young one from Petes Valley, July 12, weighed 376 grams. A large number of small young were seen during July, usually at the bases of clumps of bushes. Young in a belt of *Chrysothamnus* around the north end of Eagle Lake were already half grown, June 18, 1928.

Several young cottontails just out of nests were seen, June 7 to 10, 1929, in Petes Valley. The unfailing refuges beneath rocks in that locality pointed to the conclusion that shortage of food supply must be the main delimiting factor for this species at that place.

A young cottontail was seen, June 11, 1929, at the edge of yellow pine woods on the west side of Pappoose Valley. The next day an adult was seen, in late afternoon, hopping among fallen logs in the stub-forest near Eagle Lake Resort. Several individuals were seen, June 16, 1929, in the thickets bordering the stream in Secret Valley and on the rocky cañon walls. In mid-afternoon a half-grown one was seen in a cleared place biting off and eating grass blades.

Sylvilagus audubonii audubonii (Baird)

Sacramento Cottontail

Observed and collected at only two stations, Red Bluff, 300 feet, and Dale's, 600 feet.

A cottontail near Dale's was shot December 26, 1924, at the entrance to a retreat under a pile of fence posts. Those met with close to the Sacramento River were seen in dry, brush-bordered ditches and washes. At Cone's one was seen in the edge of a field close to a creek. When disturbed it ran to, and hid in, some streamside drift.

A female that was collected at Red Bluff on May 9, 1924, contained four embryos. Another that was picked up where it had been run over in a road, April 16, 1928, contained three small embryos.

Sylvilagus bachmani bachmani (Waterhouse)

California Brush Rabbit

Present locally in the foothills and valleys on the western slope below 3300 feet (fig. 112). Specimens collected at the following localities: Blue Tent Creek, 300 feet; Mill Creek, 260 feet; Dale's, 600 feet; Manton, 2300 feet; Lyman's, 3300 feet. Observed also on the sides of Inskip Hill.

This species was found usually close to thickets of rose or willow near the streams or under scrub oak chaparral on hill slopes. In May, 1924, individuals were trapped in runways which extended plainly through tall weeds and wild clover near a stream in the vicinity of Dale's. These runways contained cut grass and resembled to some extent those of meadow mice. On the south side of Inskip Hill, association of brush rabbits and Streator wood rats beneath dense scrub oaks seemed close, and significant in that the former had at least safety refuges, possibly breeding places, beneath the rats' houses. At Manton most of the brush rabbits lived in thickets of scrub oak or beneath piles of dead brush between those thickets. Several individuals were seen in an abandoned and overgrown thicket of blackberry.

Usually when disturbed a brush rabbit would run quietly out into a clearing and stop in plain view. After the second alarm, however, it would go into a thicket where it quickly would be lost to view.

Two females collected April 18 and 19, 1928, at Manton each contained three embryos. One set of embryos averaged five and the other eight centimeters in length. A female brush rabbit that was shot near Blue Tent Creek on May 8, 1924, contained three embryos. A young one from Manton, April 19, weighed 144 grams. Juveniles that were collected at Dale's, May 31, 1924, at Mill Creek, June 12, 1912, and at Lyman's, June 9, 10, and 14, 1924, are of sizes that range in weight between 238 and 386 grams. These facts indicate that a fairly uniform seasonal advance in reproductive activity in this species occurs throughout its range in the section.

Three adult males from Manton (April) weighed 511, 547, and 600 grams. An adult male taken at Manton in June weighed 686.6 grams and one from Dale's taken in December weighed 537.5 grams. An adult female collected at Dale's in December weighed 619 grams. Another that was taken on Blue Tent Creek in May and which contained three embryos weighed 709 grams.

Being aware that the subspecific status of the brush rabbit of the upper Sacramento Valley was in doubt, we took special pains to gather specimens of it, with the result that a series of 18 was obtained. A study of this series in comparison with the Museum's extensive materials representing the species elsewhere in the state leads us to differ somewhat from the conclusions reached by Nelson (1909, pp. 245–252, map, fig. 16). Briefly, we find that the Tehama County series falls most readily with *Sylvilagus bachmani bachmani.* From *S. b. ubericolor* of the humid coast belt of northern California, due west, our animals differ in having nowhere near such reddish brown tone of color on mid-dorsum; the sides are less brownish, more of a grayish buff; the skull in general size is smaller, the rostrum shorter, the bullae larger. Our Lassen-section animals differ from *S. b. mariposae* of the lower western flank of the central Sierra Nevada, in having somewhat browner tone of color dorsally, in smaller ear, in heavier skull with broader rostrum, and in smaller bullae.

We find much variation in *bachmani,* quite as remarked upon by Nelson under *ubericolor*; but our increased material forces us now to consider the range of the subspecies *bachmani* as extending north from the San Francisco Bay region along the inner coast ranges toward the head of the Sacramento Valley, about which it swings to the eastward to include our Tehama County localities.

Incidentally it may be remarked that the series of brush rabbits in this Museum from all localities immediately south of the Golden Gate and San Francisco Bay, including the neighborhood of Berkeley, are, in our estimation, best allocated under the subspecific name *bachmani,* rather than, any of them, under *ubericolor.*

Sylvilagus idahoensis (Merriam)

Idaho Pigmy Rabbit

Nineteen specimens collected, from January 2 to 9, 1926, in vicinity of Dransfield's (fig. 45), 5300 feet, east of Ravendale, Lassen County. One was shot July 20, 1928, three miles south of Ravendale, and others were seen in the same neighborhood. A few were seen in the vicinity of Red Rock P. O., 5300 feet. (See fig. 112.)

The homes of this rabbit were found to be situated in patches of tall, densely growing sage-brush. One individual, jumped October 16, 1924, had been feeding in a dense clump of sage-brush where the bushes were thrifty and the accumulated leaves formed mats about their bases. There were also fine tufts of a kind of bunch grass. The soil at Dransfield's was not rocky but appeared to be loamy. When approached to within ten feet a rabbit would hurry across an open place to dense cover of sage-brush about twenty feet distant. The animal moved with short, swift hops and did not bound high off the ground (Dixon, MS).

A pigmy rabbit which, on January 3, 1926, ran into a hole, came out three minutes later in answer to a "squeak" such as the collector uses to call small birds. In another case, an individual was dug out of a burrow; but it was captured by hand at least four feet short of the end of the burrow. This animal, in hand, kicked and made vigorous attempts to escape, and it seemed strange that it had not taken advantage of the full measure of refuge afforded by its burrow. One pigmy rabbit was trapped at the entrance of a regularly occupied burrow (fig. 178) which was within ten feet of a path along which persons walked several times daily. This animal had behaved so inconspicuously that its presence had remained unsuspected by the people who used the path (Borell, MS).

Colonies of this species were found by looking in the more dense clumps of sage-brush for groups of the burrow openings. Nearly all the burrows were less than one meter in length and most of them were less than one-half meter below the surface. Some had two openings to the surface. One occupied burrow had at the bottom a pocket 200 by 300 millimeters, but there was no nest material of any sort present. The following are diameters, in millimeters, of several burrows that were occupied: 65 by 75, 75 by 90, 65 by 90, 100 by 100, 180 by 205; and one that ran between two large roots was 50 by 100 (Borell, MS). In the case of the largest burrow, this may have been dug originally by a badger. But it was the collector's impression that for the most part the pigmy rabbits had constructed their own burrows.

In this species, as in other rabbits, the females are larger than the males. Twelve females of the winter-collected series from Dransfield's averaged 423 grams in weight (368–459). The six males averaged 405 grams (375–435). All these specimens were adults, in the sense that none showed any characters of juvenility; at this date, of course, the youngest could hardly have been less than six months old.

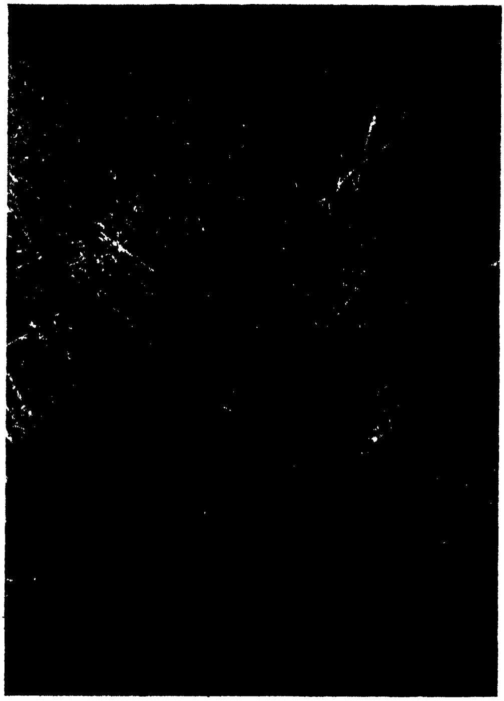


Fig. 178. Entrance to burrow occupied by a pigmy rabbit (*Sylvilagus idahoensis*). Shows characteristic oval-shaped outline, and marked trench leading to hole. Photograph taken January 8, 1926, at Dransfield's. Mus. Vert. Zool. no. 5553.

The series of skins obtained within our Lassen section showed uniformly a strikingly pallid, even whitish, cast of color, enough different from the pigmy rabbits available at the outset from elsewhere in the general range of the species, as to suggest the possibility of marked geographic variation. To test out this matter, of variations and their significance, efforts were instituted to gather together material from all possible sources, representative of all seasons and as many localities as possible. In the winter of 1926–27 Miss Alexander and Miss Kellogg, by special effort, obtained for the Museum a series of 35 pigmy rabbits from several localities in Lander and Nye counties, Nevada. Furthermore, meeting our request favorably, the United States Biological Survey has loaned us nearly all the specimens in its collection, 42 in all. Other accessible material, chiefly that already contained in the Museum of Vertebrate Zoology, brings the total number of skins, nearly all with skulls, before us at this writing (March, 1928) to 108.

Doctor E. W. Nelson, when he monographed the rabbits of North America (1909, pp. 275–278, fig. 18, pl. 13), dealt fully with the characters, variations, and distribution of "*Brachylagus*" on the basis of the 44 specimens then available for his study. Subsequently, with a better series of skins from a single locality to study, H. E. Anthony (1913, pp. 20, 24, pl. 2) was able to contribute some important supplementary information in regard to seasonal changes of color. The advantages we ourselves now enjoy, of still more abundant material for study, make possible confirmation of many of the statements and conclusions of the above authors, and extensions of their ideas, but also seem to warrant some differences in interpretation.

Briefly, as to the question of possible geographic variation within the species *idahoensis*: Without presenting here the details, our close examination and numerous measurements bring out no appreciable differences in general size or in skull characters between comparable specimens from any two of the localities (such as central Nevada and Lassen) represented in our large aggregation of materials. Indeed, we have not detected, even, the cranial tendency suggested by Nelson. We thus agree with him that this rabbit is quite rigidly uniform throughout its range. In only one feature is there possible variation, and this is probably of ontogenetic rather than phylogenetic meaning: Animals from the northern and colder parts of the range of this species appear to have a slightly heavier coat of fur in winter than those from farther south.

However, some facts have been established by our study which bear importantly upon the interpretation of the relation of the pigmy rabbit to other groups comprising the Leporidae.

Considering the question of molts, it has been accepted as a fact by all previous authors that in this species two annual molts occur. The placing of this species thus with those rabbits which are known to have two annual molts (Nelson, 1909, p. 29), as far as we can find from the literature, apparently was based upon the observed fact that winter and summer pelages of pigmy rabbits differ conspicuously in color. No direct evidence, that is, as might have been afforded by specimens showing a spring molt actually in progress, was presented. Moreover, Nelson makes two other statements which tend to cast doubt upon the two-molt idea. He says (*loc. cit.*, p. 30) in commenting upon the peculiar color of freshly molted fall specimens of the pigmy rabbit that "some freshly molted fall specimens of *Sylvilagus a. baileyi* from Wyoming, however, have considerable resemblance in general color to this pelage of *idahoensis.*" In another place (p. 278) he says of *idahoensis:* "The winter pelage is lost at an earlier date than in any other American species of rabbit which has two annual molts." This suggests at least that *idahoensis* is not as regular in its molts as are the two-molt members of the genus *Lepus.*

H. E. Anthony (1913, p. 20) has demonstrated clearly, what we found out later for ourselves independently, that the pronounced change in color between the freshly molted fall specimens and those shot in December is to be accounted for by the fading and abrasion which takes place in the individual hairs. Now the *amounts* of change between the pelage of *idahoensis* in early summer and the pelage in midwinter and between that of midwinter and early fall are practically equal. Moreover, a close examination of skins representing these three seasons shows that the processes described by Anthony continue through the year from the time of one fall molt to the time of the next fall change of pelage—*without any intervening "spring" molt.*

The skins of critical use in determining the presence of any supposed process of early "spring" replacement of pelage should be of dates in January, February, and March, according to the ideas of those preceding authors who have expressed themselves in this matter. Our present resources afford abundant material of January take, up to the 9th. In the Biological Survey series is one of date January 16 (from Paradise, Nevada). Then, by loan from Mr. Stanley G. Jewett, we have two skins of date January 26 (from Waverly, Oregon). And finally, the Biological Survey collection furnishes two specimens of date February 22 (from Burley, Idaho) and thence on at frequent intervals through March (from a number of localities). Scrutiny of the pelt and pelage in all these examples fails to disclose any place on any specimen where partly grown-out hairs occur, such as we *do* find on August-taken animals, then in the midst of the complete annual molt. The change in color and in quantity of pelage, judged on the basis of selected individuals (so as to account for probable variation with climate in stage of seasonal advancement), is found to progress correlatively with the loss of some hairs, the breaking off of the white tips of others, and the becoming brighter brown (effect of light on the pigment?) of the brown band that is present in each of most of the longer hairs. Most especially is there no trace of pelage increase on the ears and feet, where it might be easily detected; there, we see only abrasive or disruptive effects, most conspicuous on the most exposed surfaces.

As a further test, we selected a very "white" midwinter example (no. 36358, Mus. Vert. Zool., Dransfield's, January 7) and subjected a patch of pelage on its side to scraping with a dull knife, in order to induce a rapid artificial abrasion which, it was thought, would simulate the natural wear over a period of several months. In the first scrapings the long light terminal portions of the overhairs were predominant. In later scrapings more of the longer black-ended overhairs were broken off. The end-result was a patch which appeared nearly like the side of a representative specimen of summer date (no. 35055, Mus. Vert. Zool., Reese River, Nye County, Nevada, June 4). The rather astonishing annual cycle of color change in *idahoensis* may thus be chronologized briefly as follows: "pinkish drab," September and October; "silver gray," December and January; "brownish gray," February to May; varyingly "burnt" grayish brown, June to August.

In those species of *Lepus* which molt twice annually, the summer and winter pelages appear to have a sufficiently different texture so that a difference is appreciable to the touch. No difference in texture between summer and winter pelages in the specimens of pigmy rabbit available could be detected by us. But of course the pelage is much shorter and thinner in summer specimens than it is in winter ones.

If the several lines of evidence cited above have been correctly aligned by us, it would appear that henceforth the pigmy rabbit should be considered as having only one annual molt, which occurs in August and September, quite as in the cottontail and brush rabbits.

Comparisons of significance may be made at this point between the range of *idahoensis* (fig. 179) and the ranges of other groups of rabbits in the same territory or in near-by territories. *Sylvilagus nuttallii* is found in the same region as *idahoensis* but also ranges over a much larger area. (See Nelson, 1909, p. 199.) *S. nuttallii* consists of three generally recognized races. The area of intergradation between two of these races (*nuttallii* and *grangeri*) lies close to the center of the range of *idahoensis* and in a belt which extends northeast to southwest. In the case of *Lepus californicus* which also occupies a common area with the pigmy rabbit, the species ranges over a much larger area than *S. nuttallii* and a great many more races have developed. However, the two (*deserticola* and *wallawalla*) which occur in the territory now being considered meet in nearly the same belt as those of *S. nuttallii.* In the case of both the jack rabbit and the cottontail, the races which occupy territory in common with the pigmy rabbit also range for a considerable distance beyond the territory of *idahoensis.* It seems probable that the differentiation of each is largely due to conditions effective outside the range of *idahoensis.* These conditions may well be those which limit the territory of *idahoensis.*

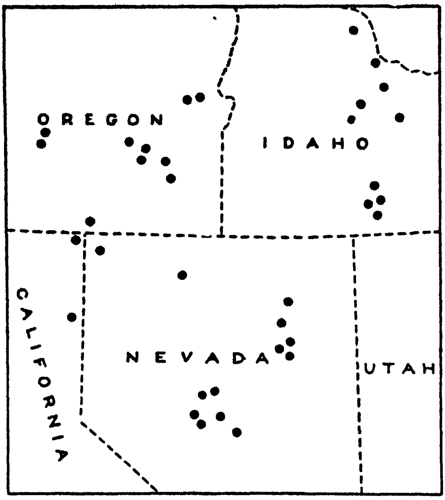


Fig. 179. Record stations of *Sylvilagus idahoensis* in western United States.

The striking resemblance of the Californian brush rabbit (*Sylvilagus bachmani*) and the pigmy rabbit (fig. 180) in size and in habits has prompted an examination of both species in order better to understand the relationship between the two. First, the range of *bachmani* including its numerous races was examined. The closest approach of the known ranges of these two species is in the Lassen section where they have been collected at stations only ninety miles apart, though separated by a belt of mountainous territory unsuited to either species. The race of brush rabbit which approaches nearest to the desert side of the Sierra Nevada is *S. bachmani cinerascens.*[1] Specimens of this race have been collected at Bodfish on the Kern River in eastern Kern County, California, and individuals have been seen (Grinnell,

---

[1] The name *cinerascens* is used here for the race exactly as defined by Nelson (1909, p. 252). Examination of material in the Museum of Vertebrate Zoology, including topotypes of the "subspecies" (*virgulti*) recently proposed by Dice (1926, p. 24), has failed to disclose to us any good ground for further division of *cinerascens*, as Dice essays to do.

MS) still farther east in Walker Pass, which leads out onto the Mohave Desert. Between this point and the range of *idahoensis* is almost continuous territory which seems to differ but slightly from that occupied by the latter species. Since it is in this region that the pigmy and brush rabbits resemble one another in habitat choice more closely than at the north (for example, in the Lassen section), and since the intervening habitat here appears more favorable, and more continuously so, to each than anywhere else, it seems reasonable to expect that, if the two species are closely related, the closest morphological resemblances *might* be found between the two in this region.

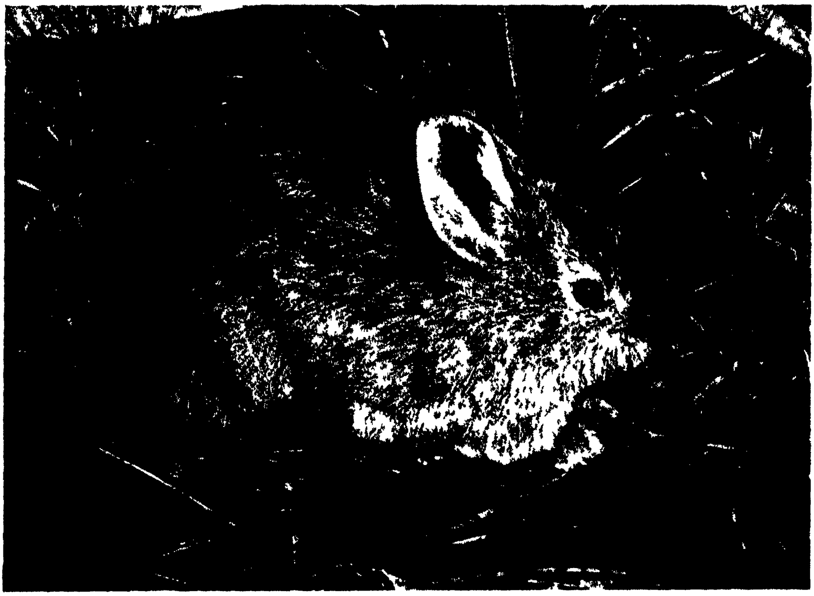


Fig. 180. Captive pigmy rabbit (*Sylvilagus idahoensis*) caught at Dransfield's in early January, 1926. Shows positions and relative sizes of appendages when animal is crouching. Photograph taken January 12, 1926, at Berkeley. Mus. Vert. Zool. no. 4827.

The pigmy rabbit was made the type of a new subgenus, *Brachylagus,* by G. S. Miller (1900, p. 157). As result of an extensive study of the relationships of the hares and their allies, Lyon (1904, pp. 411 ff.) raised *Brachylagus* to the rank of genus and pointed out several characters of the cranium and skeleton which he thought served to distinguish this form from members of the genus *Sylvilagus.* Lyon had no skeletal material, except skulls, representing the brush rabbits (*S. bachmani*). However, on the basis of the material he did have, he gave to the brush rabbits the rank of a subgenus (*Microlagus* Trouessart, 1897, p. 660). Nelson (1909, p. 42) failed to find characters of sufficient weight to warrant the subgeneric separation of the brush rabbits from the cottontails and therefore he rejected *Microlagus*; but he maintained *Brachylagus* in full generic status.

The skeletal material now available makes possible a more thorough investigation of the relationships of the cottontails, brush rabbits, and pigmy rabbits than has heretofore been made. Comparison of these three groups, especially in respect to those features which have been emphasized as characterizing the supposed genus *Brachylagus*, gives results as follows:

The possession of a ridge on each transverse process of the lumbar vertebrae has been cited (Lyon, 1904, p. 415) as peculiar to the pigmy rabbit. In the available specimens of *S. bachmani* (five individuals) this ridge is present and it is even more marked than it is in any of four specimens of pigmy rabbit examined in this regard.

The pigmy rabbit has nine caudal vertebrae. Concerning the number in *Sylvilagus*, Lyon (1904, p. 399) gives the number as from eleven to fifteen, and he remarks that "the larger number is the more usual." A skeleton of *S. bachmani bachmani* from Berkeley has eleven caudal vertebrae.

"Radius distinctly shorter than humerus" is another feature which has been cited to distinguish *Brachylagus*. Examination of skeletons shows that this statement is true quite as well of *S. bachmani*.

The teeth of *Brachylagus*, it has been pointed out, are simple in several respects. The enamel is folded less and has fewer crenations than it has in other rabbits. For example, in *idahoensis* there is only one reëntrant angle on the anterior face of the first upper premolar (Pm^2). In *bachmani* there is one prominent angle with, on either side, a much less conspicuous one. Accompanying this condition the "lateral lengths" of the posterior portions of the three lower molariform teeth are only about one-half the lateral lengths of the anterior portions to which they belong. This situation is practically duplicated in the lower teeth of *S. nuttallii grangeri* and is approached closely in at least one race (*cinerascens*) of the brush rabbits. However, in other races of the brush rabbit the relation between these portions of these teeth is nearer that usually ascribed to *Sylvilagus*. It is of interest, in this connection, that in one specimen (no. 36360, Mus. Vert. Zool.) of *idahoensis* the first upper premolar (Pm^2) on either side is absent; no trace of even the alveolus is present.

The short, tapering rostrum, so conspicuous in *idahoensis,* marks an extreme of a tendency that can be traced through other groups of rabbits. Enlargement of the auditory bullae and inflation of the temporal region of the cranium appear to be manifestations of the same tendency. In each of the two species of rabbit (*Lepus californicus* and *Sylvilagus nuttallii*) which are represented by races in the territory which *idahoensis* occupies, those races that are found in that territory are distinguished from adjacent forms by just those characters which serve to characterize *idahoensis.* In the case of each of two other species (*S. auduboni* and *S. bachmani*) the race which inhabits territory environmentally most like that of *idahoensis* also is distinguished from others of its species by those features which have been considered peculiar to "*Brachylagus.*" In other words, the environment in the northern part of the Great Basin appears to affect each of the several groups of rabbits that are found there and to affect them in the same or in closely similar ways. The same tendencies have been pointed out in certain rodents (*Lagurus* and *Neotoma*) which inhabit this region (Taylor, 1911, p. 256, and Goldman, 1910, p. 76).

It appears, then, that those characters of the skull of *idahoensis* that have been the basis, chiefly, for giving that species generic rank are evidences of an adaptive response which is of the same sort, only slightly more accentuated, as that in other rabbits and in some species of rodents that are found in the same or closely adjacent territory.

Accompanying the hiatus in characters of the skull which is evident between *idahoensis* and its nearest (as seems to us) relative, *S. bachmani cinerascens,* is a hiatus of over two hundred miles of territory with, of course, not altogether favorable environmental conditions.

A comparison of the natural history of *idahoensis* with that of other rabbits gives further basis for judging relationships. Such a comparison indicates closest agreement between brush rabbits and pigmy rabbits with respect to several features of their homes and habits. Both rabbits adhere closely to one special type of dense, low-growing thicket for cover. Even though the species of plants are entirely different, the growth-forms of these plants in the respective habitats of the two animals are closely similar.

These rabbits agree, furthermore, in possessing forage beats, with short radii, which nearly coincide with the closely circumscribed thickets which the animals inhabit. In addition, both these rabbits habitually make use of definite paths in moving from point to point within their individual home ranges. In the case of the brush rabbit these runways are sometimes roofed over with grass much as are those of *Microtus.* In the general range of the pigmy rabbit, where there is a scarcity of low vegetation, the paths are usually unroofed and appear like those of *Lagurus,* a microtine rodent which lives under similar conditions.

Consideration of all the evidence reviewed in the foregoing paragraphs leads to the conclusion that the pigmy rabbit is a relatively uniform and well marked species whose relations to other groups of the Leporidae have not been hitherto expressed by systematic workers exactly in accordance with the facts. On the basis of favorable material, it seems now fair to say that the brush rabbits are slightly more removed from the cottontails than Nelson (1909, p. 42) believed and that the brush rabbits and pigmy rabbits are much more closely related than has been previously suspected. Indeed, we ourselves are left no alternative but to believe that the pigmy rabbit of the Great Basin is a geographic offshoot from an early brush rabbit stock previously differentiated in the so-called Californian fauna.

With regard to the question of generic subdivision, three courses appear now to be open: (1) to put the pigmy rabbit in together with the brush rabbits to form a genus *Brachylagus*; (2) to separate the brush rabbits under the genus name *Microlagus* from the pigmy rabbits (*Brachylagus*) on the one hand and from the cottontails (*Sylvilagus*) on the other; (3) to include the pigmy rabbits, the brush rabbits, *and* the cottontails, as merely well marked species (or groups of species), all under the one generic name *Sylvilagus.* In our opinion, if consistency in generic "splitting" elsewhere in the Leporidae is not to be upset, and if phylógeny is properly to be reflected in systematics, then the last course indicated is necessary. Accordingly, we use the name *Sylvilagus idahoensis* (Merriam) for the Idaho Pigmy Rabbit.

Odocoileus columbianus columbianus (Richardson)

Columbian Black-tailed Deer

The summer range of the black-tailed deer in the Lassen section occupies the westward drainage and extends from the neighborhood of Inskip Hill eastward to Lassen Peak. It reaches eastward around the northwestern base of Lassen Peak at least to the vicinity of Manzanita Lake. In the southern portion of the section it has been found to extend down Warner Creek from Hot Springs Valley (Drakesbad) to Lake Almanor and thence eastward to the vicinity of Westwood.

Black-tailed deer were reported as occurring in the vicinity of Snag Lake. It is entirely possible that a few individual black-tailed deer wander into this territory. However, all the deer definitely identified by our collectors between the east base of Lassen Peak and Snag Lake were found to be mule deer and not black-tailed.

In winter, the entire black-tailed deer population moves westward and downward to lower altitudes, wintering below the 3500-foot contour line. Individual deer go as far west as, and even across, the Sacramento River, where they come into association with deer from the Coast Ranges.

On May 30, 1927, black-tailed deer were especially numerous in the vicinity of Mineral where they were then moving upward to their summer range in that region. Mr. A. Sifford, who has resided for many years in Hot Springs Valley (at Drakesbad), in 1923 reported that deer had returned to Hot Springs Valley as early as May 6 but that this was an unusual occurrence, since the winter had been open and the light fall of snow had disappeared early. The year previous to this, 1922, the deer had not returned to Hot Springs Valley by May 26. These two years are representative of extreme conditions, since the winter of 1922 was severe and the return of the deer was delayed accordingly.

On July 27, 1925, on Broke-off Mountain, fresh deer tracks were seen up to 9200 feet (Grinnell, MS). This is the highest point at which we observed deer sign in the Lassen section. On the headwaters of Warner Creek tracks of three deer were seen in a meadow at 7500 feet. This is believed to be about the maximum altitude reached by black-tailed deer in that vicinity.

The downward migration of the deer in this vicinity was found to begin, in 1924, on September 23, following the arrival of the first heavy (24 inches) snowstorm of the season. This represents the extreme early date of migration. In some instances, during other years, the first considerable fall of snow of the season and the resulting downward migration of the deer has occurred at least one month later than the above date. (See fig. 181.)

The transition from the red summer coat to the blue winter coat was found to occur earlier in bucks than in the does and fawns. Thus, at 5200 feet on Warner Creek, near Kelly's, on September 19, 1924, out of seventeen does observed all were still in the red summer coat, while two bucks, a forked horn and a 4-pointer, were already nearly or quite in the full blue winter coat.

On September 2, 1925, in the same locality, a large 4-point buck was observed with horns still in the velvet, head and neck having a decided blue color but the rest of the body showing remnants of the red summer coat. Two does observed at the same time were still in the red summer coat. A forked-horn buck killed September 23, 1925, in the same locality, had a few patches of blue hairs showing through on its neck. The red summer coat predominated on other portions of the body.

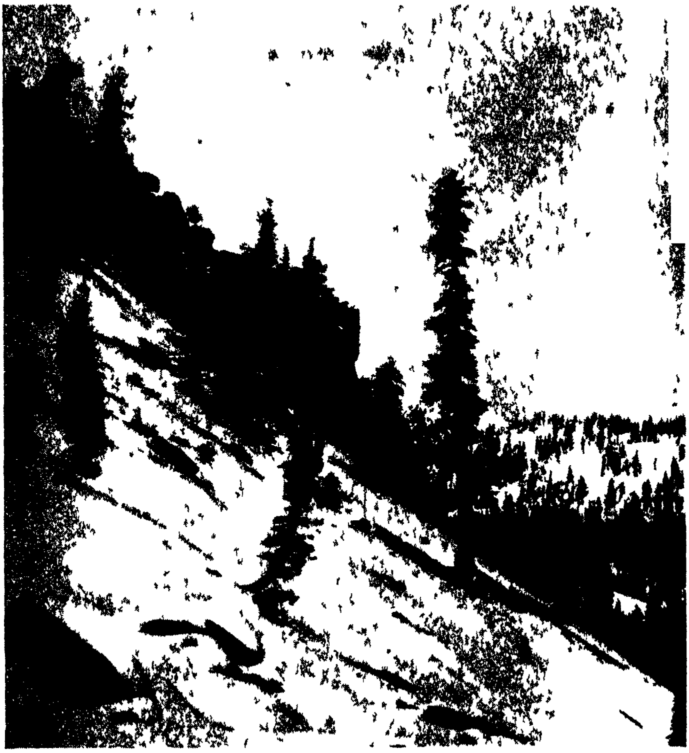


Fig 181. Habitat occupied by Columbian black tailed deer (*Odocoileus columbianus columbianus*) in summer. All deer left this locality before the first heavy snow in the fall. Much of the forest on the higher ridges of the section is of the scattered type shown on far right Photograph taken September 28, 1923, near Warner Creek at 6600 feet. Mus Vert. Zool. no. 4248.

On June 28, 1924, at a locality two miles west of Black Butte, 6800 feet, a deer was encountered in a dense thicket of manzanita. The animal, a buck, was concealed by the thick brush until it suddenly thrust its head out when the observer approached to within thirty feet of its hiding place. Deer of this species were found at many other localities to be closely associated with manzanita thickets which afforded both cover and, at least as regards associated plants, food. Thus around Mineral, and on Warner Creek, deer were repeatedly found during the daylight hours in manzanita and snow-brush thickets. Many of the animals remained hidden until the human intruder came within a few feet of them. Thickets of huckleberry oak were also utilized as hiding places, as well as were dense thickets of young white fir and yellow pine.

Repeated observation showed that as long as a person remained motionless, even though within fifty feet and in plain sight of the deer, he would usually escape detection. Thus near Mineral, at 5200 feet, on June 17, 1924, a doe and a young buck with antlers about two inches long and still in the velvet, were located. The animals did not know that they were being watched. The buck lay down, kneeling front legs first, cow fashion. Then the doe walked around and stopped within fifteen yards of the observer, there being not even a log or a bit of brush between the deer and the person watching them. Both deer looked at the observer but appeared not to see him, or at least not to recognize him as a potential enemy.

Near Lyman's, June 14, 1924, a deer that had been watched for some time became frightened and, in leaving, rather than going around an obstructing board that was nailed between two trees, jumped over the barrier. The tracks left in the soil gave an accurate record of the jump, so that the following measurements could be made: total length of the jump, 5.82 meters (18 feet 11 inches); height of board from the ground, 1.25 meters; distance from starting point to board, 3.92 meters. The only noise that was heard when the deer made this leap was a slight thump when the animal hit the ground at the end of the leap (Borell, MS).

Beds of the black-tailed deer were found frequently in manzanita or thickets of conifers. At other times they were found on steep and almost inaccessible cañon walls, as was illustrated by numerous beds which were found on July 4, 1924, on the north broken rim of Battle Creek cañon.

In the neighborhood of Mineral, on June 21, 1924, an example was noted of a type of combat sometimes resorted to by deer, particularly does. Two deer reared themselves on their hind feet and stood facing each other. Then each individual pounded the other rapidly about the head with its forefeet. The animal on the lower level was thus at a disadvantage and turned and ran, being pursued by its opponent. This type of combat is rarely, if ever, indulged in by bucks at this season of the year, and the contestants in the above mentioned case were presumed to be does although the action was so rapid that the sex could not be definitely ascertained. At this date (June 21, 1924) the antlers of the bucks were still in the velvet and very sensitive, and great care is taken not to give them any unnecessary bumps.

At Hot Springs Valley (Drakesbad), in 1923. the rutting season in the black-tailed deer had definitely begun by October 9. On this date males were seen in pursuit of females. However, we do not believe that actual mating took place until somewhat later. The period of gestation in the black-tailed deer, according to our information, is about seven months. The earliest record that we have of fawns in the spring at Battle Creek Meadows, 4800 feet, is June 20, 1925.

The following instance of behavior of a fawn is cited as representative of the species in this region. At Mineral, on June 26, 1925, a fawn was "jumped" near camp from a bed under a very small fir surrounded by dense thickets of snow-brush (*Ceanothus cordulatus*). The young deer managed to get through the mass of entangling brush with a minimum of disturbance, and the observer recorded that it bore close resemblance in action to an adult jack rabbit, especially so when in the brush. However, when the fawn bounded into the open beyond the brush its movements were typically those of an adult deer, although the fawn was at most not more than one-fourth grown.

On Broke-off Mountain on June 17, 1925, tracks of a fawn were discovered in a trail, though the animal itself was not observed. This is the earliest indication we have of the presence of fawns in that neighborhood.

Hybrids between black-tailed and mule deer occur not infrequently in the Lassen section, where the ranges of the two species overlap. Thus, on Warner Creek, at 6600 feet, in the fall of 1923, Dixon observed at the beginning of the rutting season does of both species being pursued by a mule deer buck. Furthermore, he has examined, through the courtesy of Mr. Gus Nordquist, a fresh specimen, complete skin-with-skull, of a buck taken in the vicinity of Mineral which had characters of both mule and black-tailed deer. From other localities in the state where mule deer and black-tailed deer occur in the rutting season, unquestioned hybrid specimens have been obtained. There is a general tendency for black-tailed bucks to reach maximum size in those areas where the ranges of the two species overlap, in other words, where hybridization or interbreeding occurs. This statement is based primarily upon actual specimens, obtained by hunters in the open season, as sent in to the taxidermist, Mr. Gus Nordquist of Oakland, California (*teste* J. Dixon).

A probable explanation of the relative infrequence of interbreeding is the fact that the mule deer migrate eastward at the approach of winter, whereas the black-tailed deer migrate westward, the separation of the populations taking place before the time of breeding. Another outstanding factor is that the breeding season of the black-tailed deer occurs two or three weeks earlier than that of the mule deer.

It was a matter of interest to us to find that black-tailed deer, as evidenced by their tracks, visit regularly mineral deposits at the Devil's Kitchen. Thus, on June 23, 1925, numerous deer tracks were found within a few feet of boiling water in the geysers, and four deer were seen within a few hundred yards of the Devil's Kitchen. The tracks indicated that the deer were in the habit of coming regularly to lick the mineral deposits.

At Willow Lake, on June 23, 1924, there existed an area on the east of the lake where there was an extensive growth of water lilies, some of which had been exposed by the lowering of the water. The exposed lilies had been almost entirely devoured by deer, the animals leaving the mud tramped full of tracks (R. Hunt, MS).

On May 22, 1927, a deer near Mineral was jumped from beneath thick young firs in woods of larger trees including black oaks. Going to the spot, the observer saw several places where the ground was freshly turned. Footprints of deer in each such freshly earthy place showed that the work was done in part at least by "pawing." The objective was in each case a tender, branching fungus; for "crumbs" of this were found in each place mixed with the fresh earth. This fungus had something of the texture and appearance of cooked cauliflower. It apparently did not come into view, but merely lifted a little the surface layer of black oak leaves and fir needles. The observer found some uninjured examples by looking for cracked places in the surface litter. It was supposed that the deer locates this fungus by smell. A specimen of the fungus was preserved in formalin and was later identified by Professor Lee Bonar as belonging to the species *Clavaria formosa* Persoon. This is a fungus that is "found very generally distributed over the world in temperate zones." (Grinnell, MS.)

On September 20, 1924, at Kelly's on Warner Creek, deer were found to be feeding extensively on huckleberry oak and the leaves of currant bushes. It was observed that the currant leaves were not sought when they were green; but as soon as they began to turn yellow, after frost, they were immediately much sought after by the deer.

On September 3, 1925, a forked-horn buck was shot. This deer had been feeding in a wild plum thicket. Stomach contents of this animal were found to weigh twelve pounds. Examination showed that the contents consisted of leaves, twigs, and at least fifty fruits, of the wild plum.

A favorite winter food of the black-tailed deer in the lower foothills is found in the buck-brush (*Ceanothus cuneatus*). Acorns of both black oak and blue oak also constitute an important article of diet of the black-tailed deer on their fall and winter, particularly winter, range.

A large, 4-point black-tailed buck was killed October 9, 1923, near Hot Springs Valley, Plumas County, by Mr. L. A. Braden, sheriff of Plumas County. The weight of this deer (dressed, gutted, but with head and feet on) was estimated, in pounds, by five different men, as follows: 145, 150, 155, 162½, and 165 When actually weighed, on the Outdoor Life hunting scales, this buck was found to weigh 162 pounds. The measurements of this buck were, in inches, as recorded in the field: length, 64; tail (bone), 6; hind foot, 18; ear from crown, 9; greatest breadth of antlers, 19¼; length of antlers measured around curve, 21; circumference of antlers at base, 5; length of front hoof, 3; width of front hoof, 2; length of hind hoof, 3; width of hind hoof, 1¾. The metatarsal gland of this deer measured only 1½ inches in length.

An average forked-horn black-tailed deer, killed September 20, 1924, at Kelly's, on Warner Creek, was estimated to weigh 100 pounds. This deer was in rather thin flesh. Actual weight of this animal (dressed, gutted, but with head on) was found to be 82 pounds. Measurements, in inches, were as follows: length, 58½; tail, 8; hind foot, 17½; ear from crown, 8; metatarsal gland, 3; height at shoulders, 33; spread of antlers, 9¾; length of antlers measured around curve, 13; circumference of antler at base, 2¾.

Another forked-horn buck, killed September 3, 1925, was found to weigh 80 pounds when dressed, gutted, but with head and feet on. Measurements, in inches, were as follows: length, 56; tail, 7; hind foot, 17; ear from crown, 8; metatarsal gland, 3¼; spread of antlers, 11½; length of antlers around curve, 12½; circumference of antler at base, 3.

A 4-point black-tailed buck, killed September 2, 1925, by Will Kelly, on Warner Creek at 5200 feet, when gutted but with head and feet on, was found to weigh exactly 180 pounds. It was conservatively estimated that the animal, entire in the flesh, would have weighed over 200 pounds. Measurements of this animal, as taken by Dixon, were, in inches, as follows: total length, 63; tail, 7; hind foot, 19; ear from crown, 8; width of ear, 3½; metatarsal gland, 3¼; spread of antlers, 23¾; length of longest antler around curve, 24; circumference of antler at base, 4½.

One of the outstanding characters of the black-tailed deer is the V-shaped tail which stands out in marked contrast with that of the mule deer, which is constricted at the base. The tail of the last-mentioned buck was 4 inches in breadth at the base. Another point of difference which we have found to be of greatest use in distinguishing black-tailed from mule deer is the size (length) of the metatarsal gland which in the adult black-tailed deer is usually less than 3½ inches in length, whereas in the adult mule deer the length of this gland is, in comparable individuals, 5½ inches; even in young mule deer it is 3 inches or more in length.

To judge from the comments of Townsend (1887, pp. 164 ff.) the status of the two species of deer in the Lassen section was about the same when he was there in 1884 as it is today. In the region "sloping eastward from Mount Lassen" black-tails occurred as "stragglers," the mule deer being the prevalent species.

Odocoileus hemionus hemionus (Rafinesque)

Rocky Mountain Mule Deer

The mule deer ranges in summer more than halfway across the section from the east. In the winter this population withdraws to the eastward. We were told by persons living in the vicinity that some of the deer remain during mild winters in that part of the section east from Eagle Lake but that in severe winters all of them move out and into Nevada. From the same informants we learned that the movement around the north end of Eagle Lake begins in November and that deer have been seen in spring on the west side of the lake as early as the last of March.

With regard to altitudinal range, a mule deer buck was observed, September 16, 1923, on the ridge between the headwaters of Warner Creek and Hat Creek at the east shoulder of Lassen Peak at an altitude of approximately 8000 feet. On September 11, 1923, a doe was observed to come and drink at a spring which was the highest water in that region (8300 feet).

At 6600 feet on Warner Creek, September 18, 1923, mule deer were found to be numerous. Hunters claim that both black-tailed and mule deer occur at this point and our observations tend to show that there are good grounds for this statement, since two does which were observed at close range at 6600 feet on Warner Creek were unquestionably mule deer. Black-tailed deer were also observed near this point. However, it is our opinion that the deer occurring in the Lassen section from the vicinity of Snag Lake eastward are, without exception, mule deer. Thus, mule deer were found to occur, though sparingly, in the vicinity of Fredonyer Peak east of Eagle Lake. At this point, on October 7, 1924, a large buck was found bedded down at mid-day in a thicket of mountain mahogany. This buck had been much hunted and had become exceedingly wary, so much so that he escaped by sneaking out of the thicket that he had been hiding in without our being able to secure sight of him until he was out of gun range.

Fresh deer tracks (two adults and a fawn) were found in a trail at a spring near the head of Slate Creek. Mule deer were also found on Observation Peak where, on October 15, 1924, nine deer (two bucks, four does, and three fawns) were jumped from a flat rocky ridge covered with mountain mahogany, at about 5800 feet elevation.

At this season of the year, fresh fall snows on the peak had driven the deer downward and they were then watering at springs on the edge of the plain. They fed at the lower altitude during the morning and usually went back and were found bedded down during the middle of the day in the thickets of mountain mahogany. From the fact that several shed antlers of mule deer were found on Observation Peak, it is our opinion that bucks do winter in this locality at least occasionally. Normally the horns of the mule deer are not shed until February, long after the winter migration and at a time when the deer are on their winter range (Dixon, MS).

We have good evidence that some mule deer do not migrate to the eastward of Lassen Peak, but that a few, at least, migrate in the fall to the westward and winter in the vicinity of Mineral. It has been noted, however, that such mule deer do not go down into the winter range of the black-tailed deer below the yellow pine belt, but that they stay all winter high up in the snow. Thus, on February 22, 1920, Mr. Gus Nordquist saw on the north rim of Battle Creek cañon, 4000 feet altitude, at a point about ten miles above Payne Creek P. O., three unquestioned *mule* deer. These deer were observed for a considerable length of time; at a distance of fifty feet, identification was positive. At this time there were about two feet of snow on the level and the deer were digging down through the snow blanket to get food, which consisted of "squaw carpet" (*Ceanothus prostratus*). One member of the band, a buck, had dropped one of its antlers, the other remaining attached. This is the westernmost record that we have of mule deer in the Lassen section.

On September 24, 1923, at 6600 feet on Warner Creek, three mule deer does were found feeding during a heavy snowstorm on currant bushes at the top of a talus slope close to the base of a cliff. The observer, standing about seventy yards distant from the deer, noted that the wind was blowing from him toward the deer. Within a few seconds an old doe was observed as she caught the scent of the human intruder. She was obviously uneasy and turned and looked and tested the wind with neck outstretched and nostrils dilated. As long as the intruder remained motionless and off the sky line the deer did not see him although obviously aware of his presence through the sense of smell. At length she looked up and saw the observer as he stood above her, by then silhouetted against the sky line.

The apparent size of an animal's tracks is not always conclusive evidence of the size of the animal. This is well shown by the following instance. A male mule deer, observed October 7, 1924, at Fredonyer Peak, was observed closely. As he walked along leisurely, on firm, moist, level ground, his tracks were 25 inches apart. The right front foot track measured 4 inches in length and 2¾ inches in width. These are the largest deer tracks that we have ever found and actually measured, in California. The deer itself, however, was not unusually large. When jumped and thoroughly alarmed, this buck covered ground rapidly. We measured two of the jumps that he made while running and found them to measure 15 and 16 feet, respectively.

Mr. William Horne, who has spent many years in close association with deer, states that in the vicinity of Observation Peak there are a good many bucks that have antlers with a spread of 28 or 28¼ inches. These are chiefly 4-pointers. The largest set of antlers he has secured in this region was measured by Dixon and found to have a spread of 31 inches. Mr. Horne states that the largest number of points, barring freak heads, that he has found on mule deer antlers was seven on one antler and eight on the other.

On May 15, 1925, deer, all mule-tails, were working westward around the south end of Eagle Lake. They were out feeding at all hours of the day, and Dixon saw a medium-sized buck feeding at noon within 150 yards of the lake. This buck was thin; his hips, shoulder blades, and ribs were all prominently visible. By the aid of binoculars the observer found that the antlers were between 3 and 4 inches in length. The buck's track measured 2¾ inches in length and was 2 inches wide. Careful comparison failed to show any difference between the track of this buck and the track of a large doe made at the same time and place.

The age of the mule deer living under normal conditions, barring accident, has been found by Mr. Horne to be about fourteen years. He has marked (as range cattle are marked) and raised ten or twelve deer which had the liberty of the range and remained free to run over the ranch of many thousand acres. Through Mr. Horne's feeding, the deer, although ranging far and wide, and sometimes absent for considerable periods, always returned to the vicinity of the ranch house. The grandmother of this herd of deer was an old mule deer doe that was captured as a fawn. She lived a normal, natural, free life and died in her fourteenth year. Mr. Horne states that when this deer was about thirteen years old she lost most of her front teeth, which "just dropped out." It is his opinion that this deer died a natural death, that is, from old age.

Mr Horne states that, judging from the deer that he has raised, a male mule deer fawn in normal strength and vigor will have its first antlers "forked-horn." A forked-horn mule buck is thus really a yearling. He cites one instance in which the buck's first antlers were 3-point on one side and forked-horn on the other. The deer at this time was known to be somewhat over one year old. Mr. Horne states that the eye guard or brow tine is not acquired by the buck until the third year. He further says that in this section of California the rut in the mule deer does not begin until November 1, or nearly one month later than in the black-tailed deer in the western portion of the Lassen section.

It is his, as well as our, belief that this is one of the most important factors in preventing the two races of deer from interbreeding more than they do. Furthermore, as a rule, the black-tails start downward and westward on their fall migration, and the mule-tails start eastward on theirs, each at the very beginning of its breeding season.

At Eagle Lake, May 15, 1925, a large mule deer doe came loping along the lake shore. She was obviously heavy with fawn and slid along gently, not bouncing stiff-legged as does are wont to do in the fall. On May 16, in the same locality, two does were jumped from the edge of the flat where they were bedded down in a dense thicket of white fir. Both were mule-tails in good flesh, and heavy with fawn.

In the eastern portion of the Lassen section, mountain mahogany was found to be the principal source of food supply for the mule deer. This was particularly true in the vicinity of Fredonyer Peak, as also on Observation Peak. In the vicinity of Lassen Peak, near the headwaters of Warner Creek, mule deer were found feeding extensively on the yellowed leaves of the wild currant bushes. During the winter the mule deer depend primarily on mountain mahogany for browse, with antelope-brush (*Purshia*) serving as an occasional substitute.

At the south end of Eagle Lake, on June 12, 1929, around twenty-five mule-deer were seen in groups of three to six. The animals were down along the edge of the water in morning and evening. They moved out into the water and drank; then stayed for some time on the open grassy portion of the shore. When moving normally these animals went at a brisk walk or easy trot, never bounding except when frightened.

At Secret Valley on June 16, 1929, a deer was jumped from the center of a dense willow thicket near the stream. The animal ran off slowly across the valley floor, stopping several times to look back. A ranch hand at that place said that, the day before, he had seen a buck, a doe, and two small fawns. He said also that deer were found regularly in that vicinity in summer though in small numbers.

Mr. C. O. Fisher has supplied us with a written summary of his knowledge of the ranges and distribution of the species of deer in Lassen County, as well as a map on which he has marked the ranges at different seasons of the year and the routes of travel most used. This information corroborates and extends the results of our own field observations as above given.

Mr. Fisher informs us that all the mule deer which range in summer in the Lassen Volcanic National Park, those in the Pine Creek watershed, and most of the ones from the Susan River watershed above Westwood Junction, migrate in the fall out through a pass in the newly relocated Game Refuge 1F, which is to the northward and eastward from Poison Lake. The deer usually pass through a certain part of the area comprised in this refuge on the way to the winter range, around October 10. After this, they move more or less slowly, arriving on the western side of the Madeline Plains about mid-November and on the winter range about mid-December. Heavy storms may cause the movement to take place earlier.

The return movement in spring is thought by Mr. Fisher to begin about March 15. The deer arrive on the lower part of the summer range by mid-April except in years when spring is late.

In summer the mule deer in this region may be found over the whole area occupied by the species at any season. However, only scattered individuals are then found in the territory which is the normal winter range for large congregations of the animals.

Odocoileus virginianus macrourus (Rafinesque)

Western White-tailed Deer

A white-tailed buck that had recently shed its horns was shot in January, 1922, by Mr. William R. Horne, who was collecting a group of deer for the Oakland Public Museum. The deer was killed three miles west of the Nevada line, in California, about eight miles northeast of Observation Peak, Lassen County. The skin was sent to the Oakland Museum. We did not see the specimen and its present whereabouts are not known. Mr. Horne said that previously he had killed a three-point white-tailed buck. The band of deer, twelve or thirteen individuals, was seen repeatedly in the neighborhood during the summer, the fall, and the winter up to the last of January. (See Dixon, 1927, p. 308.)

It is the general belief of Mr. C. O. Fisher, Deputy Fish and Game Commissioner with headquarters at Susanville, that such white-tailed deer as exist in small numbers in eastern Lassen County occupy a range coincident with the average *winter* range of the mule deer.

Antilocapra americana americana (Ord)

Prong-horn Antelope

Bands of antelope were seen by us in Poison Lake Valley, 5300 feet, and Grasshopper Valley, 5300 feet. At the latter locality, where six or seven were seen several times in the summer of 1924, a herd of at least twenty-five was present in June and July, 1928. These animals were feeding out on fenced pasture lands where cattle were also grazing. On June 18, 1928, one antelope, apart from the rest in a scattering herd of twenty-one, was being followed by two small fawns.

Two antelope together, and one singly, were seen, June 17, 1929, near a ranch seven miles south of Ravendale. The single one seemed not to want to leave the place from which it was disturbed. It would run a short distance, then would stop and face the intruder, then proceed, only to repeat the stop.

The general opinion of persons who lived in the eastern end of the Lassen section was that antelope were increasing in numbers in 1928 and that they then occurred in all the valleys from the vicinity of Poison Lake and the northern shore of Eagle Lake eastward. (See fig. 83.)

Mr. H. H. Sheldon, in July, 1928, collected material in eastern Lassen County for a mounted group of antelope to be placed in the Santa Barbara Museum of Natural History. In the region of the eastern part of the Lassen section Mr. Sheldon saw seventy-seven antelope at the following localities: Spanish Springs, eight miles south of Ravendale; near Observation Peak; Juniper Ridge, five miles north of Ravendale; Taylor Flat, thirty miles east of Ravendale. At the latter locality close to thirty-five individuals were seen in one band. The fawns were getting large and the animals, all ages and both sexes, were beginning to congregate. The balance of the ones seen were single does with fawns, and single bucks. Each of the does seen was accompanied by two fawns.

Townsend (1887, p. 169), in the summer of 1884, met with the antelope "frequently in Lassen County. . . . There it was usually found on the open, sage-covered meadows interspersed through the pine forests, and was sometimes found back among the pines, a mile or more from any open glade . . . . "—quite as today in the vicinity of Poison Lake. Townsend preserved two skeletons of antelope taken June 6 and 26.

Mr. Will R. Horne lived in the eastern part of the Madeline Plains for a period of approximately thirty-five years beginning in 1890. During this period he kept close watch over game conditions in that region. Mr. Horne (1925, p. 89) has given his appraisal of the antelope situation in his vicinity up to the winter of 1924. He says, in part:

> During the nineties several bands, numbering from 20 to 50, were scattered over the Madeline Plains and near-by tablelands in eastern Lassen County. During this period, the last band seen by the writer was a group of about 15 head in the spring of 1897. With the coming of the homesteader and the advance of the sheep industry, antelope almost entirely disappeared. Although I rode the range continuously, no more were seen until late in the fall of 1900, when quite a large band appeared on the range near my ranch. However, within a few days hunters from Susanville and other places were after them and I knew of about ten being killed. The band broke and scattered; three spent the entire winter of 1901 in sight of my house, but disappeared the following spring. From 1901 to 1909 a lone antelope was sometimes seen, then a pair, or sometimes a half dozen. By 1916 bands of 10 to 15 were not uncommon. In the fall of 1918 a herd of 75 appeared and in the fall of 1921 several bands of from 20 to 75 could be found in a day's ride. During the winter of 1924 the writer saw one band of 125 and believes there were 500 or more on this range. . . . .

The antelope of this area were counted in 1923, for the California Academy of Sciences, by W. J. Lee, who reported on September 29 that they aggregated 864 animals (Nelson, 1925, p. 27). Nelson says further that "since then it has been reported that most of these animals have crossed the State boundary into the adjacent part of Nevada, as a result of failing forage due to the excessively dry season of 1924. They will undoubtedly return with the restoration of more favorable conditions."

A still more recent observer (Cheney, 1929, p. 175) reports that in this area (Game Refuge 1Q) the ". . . . land is overgrazed and sheep camps monopolize most of the water holes. . . . ." Mr. Cheney made five trips into eastern Lassen County in 1928. The largest number of antelope seen in one day was thirty-five and "that was in February before the bands had broken up." It is Cheney's opinion that "the Lassen County resident herds do not total over 250 animals."

One point to be remembered in this connection is that much of the area in eastern Lassen County is sparsely settled and, because of the absence of roads, it is relatively inaccessible to transient observers. The only persons who have had opportunity to make careful counts of antelope here are the men who spend a great deal of time riding on the range. It is likely that these people usually over-estimate numbers in this species. Mr. C. O. Fisher of Susanville, on a basis such as was just mentioned, concluded that there were, in 1929, close to 3600 antelope in eastern Lassen County.

Our own observations, while inadequate for making a definite estimate of numbers, are sufficiently complete for us to express the opinion that Cheney's estimate is too low while Fisher's estimate is too high for conditions in 1929.

Bison bison bison (Linnaeus)

Plains Bison

The Indians of northeastern California have supplied Dr. C. Hart Merriam with information, which he considers trustworthy, and which establishes the former range of the buffalo as extending from the north into eastern California. Merriam (1926, p. 212) gives records from this source for localities in the eastern part of the Lassen section, especially the following: Madeline Plains, Horse Lake Valley, Eagle Lake Valley, the valley of Pine Creek on the west side of Eagle Lake. It is likely that no bison has occurred within this territory at least within the last century.

Ovis canadensis californiana Douglas

Lava Beds Bighorn

Records of the recent occurrence of mountain sheep closely adjacent to, if not actually within, the eastern part of the section have been furnished us by Mr. C. O. Fisher, of Susanville, Deputy for the State Division of Fish and Game. Mr. Fisher wrote to us that a band of about forty sheep that had lived on Observation Peak were thought all to have perished in the severe winter of 1922. In the summer of 1923, Mr. Fisher himself found horns and skeletons of sheep on this mountain.

In 1927, Mr. Fisher was fortunate in locating a small band of mountain sheep, thought by him to consist of four females and two males. The animals were watched for at least three-quarters of an hour at a distance of less than 150 meters. The location of this band was in one of the rugged cañons in the extreme southeastern corner of the section. Apparently the occupied range of these animals lies close to or on the Nevada line, in the territory between Smoke Creek, Chimney Cañon, Wilcox Cañon, and Painter Flat.

Mr. W. R. Horne, who is especially well acquainted with the animal life of Lassen County, writes us that he has heard of but one mountain sheep being seen in that county. This was an animal that his father saw there, presumably in the eastern end of our section, in 1872. Mr. Horne says that doubtless this species was once quite plentiful in that region, since many "very old horns" have been seen scattered over the stock ranges.

There is no trace of evidence to show that the mountain sheep ever existed on Lassen Peak or in its near vicinity. Writing of his explorations there in 1884, Townsend (1887, p. 170) says: "I learned nothing of its occurrence in the Mount Lassen region, although it is found in the high Sierras, farther south." Townsend did not extend his explorations east of Eagle Lake.

LITERATURE CITED

Anthony, H. E.

1913. Mammals of northern Malheur County, Oregon. Bull. Am. Mus. Nat. Hist., **32**, 1–27, 2 pls.

Bangs, O.

1900. A review of the three-toed woodpeckers of North America. Auk, **17**, 126–142, 2 figs. in text.

Brewster, W.

1924. The birds of the Lake Umbagog region of Maine. Bull. Mus. Comp. Zool., **66**, Part I, 1–209.

Brooks, A.

1922. On the occurrence of the buffle-head at Eagle Lake. Condor, **24**, 25–26.

Brues, C. T.

1928. Studies on the fauna of hot springs in the western United States and the biology of thermophilous animals. Proc. Am. Acad. Arts and Sci., **63**, 139–228, 7 figs. in text, 6 pls.

Cheney, E. S.

1929. Prong-horned antelope in California. Calif. Fish and Game, **15**, 175.

Day, A. L., and Allen, E. T.

1925. The volcanic activity and hot springs of Lassen Peak. Carnegie Inst. Wash., Publ. **360**, 1–190, 81 figs. in text, 13 pls.

Dice, L. R.

1926. Notes on Pacific Coast rabbits and pikas. Occas. Papers Mus. Zool., Univ. of Mich., no. 166, 1–28.

Diller, J. S.

1889. Geology of the Lassen Peak district. U. S. Geol. Surv., 8th Ann. Rept., Part I, pp. 395–432, 7 figs. in text, 7 pls.

Dixon, J.

1921. The buffle-head breeding in California. Condor, **23**, 165.
1926. The buffle-head breeds in California. Condor, **28**, 47–48.
1927. The white-tailed deer in California. Jour. Mammalogy, **8**, 308.

Fairfield, A. M.

1916. Fairfield's pioneer history of Lassen County, California. Containing everything that can be learned about it from the beginning of the world to the year of our Lord 1870 (San Francisco, H. S. Crocker Company), pp. xxii + 506, 5 ills.

Feilner, J.

1865. Exploration in Upper California in 1860, under the auspices of the Smithsonian Institution. Ann. Rept. Smith. Inst., 1864, pp. 421–430.

Goldman, E. A.

1910. Revision of the wood rats of the genus *Neotoma*. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **31**, 1–124, pls. 1–8, 14 figs. in text.

Grinnell, J.

1916. An analysis of the vertebrate fauna of the Trinity region of northern California. Univ. Calif. Publ. Zool., **12**, 399–410.
1917. The subspecies of *Hesperiphona vespertina*. Condor, **19**, 17–22, 3 figs. in text.
1922. A geographical study of the kangaroo rats of California. Univ. Calif. Publ. Zool., **24**, 1–124, pls. 1–7, 24 figs. in text.

Grinnell, J., and Dixon, J.
1924. Revision of the genus Lynx in California. Univ. Calif. Publ. Zool., **21**, 339–354, pl. 11, 1 fig. in text.

Grinnell, J., and Linsdale, J. M.
1929. A new kangaroo rat from the upper Sacramento Valley, California. Univ. Calif. Publ. Zool., **30**, 453–459, 1 fig. in text.

Grinnell, J., and Storer, T. I.
1924. Animal life in the Yosemite (Berkeley, Univ. of Calif. Press), pp. xviii + 752, 62 pls., 65 figs. in text.

Hall, E. R.
1926. The abdominal skin gland of Martes. Jour. Mammalogy, **7**, 227–229.

Hall, H. M., and Grinnell, J.
1919. Life-zone indicators in California. Proc. Calif. Acad. Sci., ser. 4, **9**, 37–67.

Henshaw, H. W.
1879. Ornithological report from observations and collections made in portions of California, Nevada, and Oregon. Appendix L, Ann. Rept. Chief Engineers for 1879, Ann. Rept. Geog. Surv. West 100th Meridian, by George M. Wheeler, pp. 282–235. [Issued in February, 1880.]

Horne, W. R.
1925. The return of the antelope in Lassen County. Calif. Fish and Game, **11**, 89.

Howell, A. H.
1924. Revision of the American pikas. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **47**, pp. iv + 57, 6 pls., 4 figs. in text.

Hunt, R.
1922. Evidence of musical "taste" in the brown towhee. Condor, **24**, 193–203.
1923. Another musical brown towhee. Condor, **25**, 134.

Jackson, H. H. T.
1915. A review of the American moles. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **38**, 100 pp., 6 pls., 27 figs. in text.
1928. A taxonomic review of the American long-tailed shrews. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **51**, vi + 238, 13 pls., 24 figs. in text.

Jepson, W. L.
1925. A manual of the flowering plants of California (Berkeley, Assoc. Students' Store, Univ. Calif.), 1238 pp., 1023 original drawings.

Kellogg, L.
1916. Report upon mammals and birds found in portions of Trinity, Siskiyou and Shasta counties, California, with description of a new *Dipodomys*. Univ. Calif. Publ. Zool., **12**, 335–398, pls. 15–18.

Kellogg, R.
1918. A revision of the *Microtus californicus* group of meadow mice. Univ. Calif. Publ. Zool., **21**, 1–42, 1 fig. in text.
1922. A synopsis of the Microtus mordax group of meadow mice in California. Univ. Calif. Publ. Zool., **21**, 275–302, 1 pl., 29 figs. in text.

Labarthe, J.
1922. Further remarks on the occurrence of the buffle-head at Eagle Lake. Condor, **24**, 68–69.

Linsdale, J. M.

1928. Variations in the fox sparrow (Passerella iliaca) with reference to natural history and osteology. Univ. Calif. Publ. Zool., **30**, 251–392, pls. 16–20, 38 figs. in text.

Lyon, M. W.

1904. Classification of the hares and their allies. Smithsonian Misc. Coll., **45**, 321–447, 26 pls.

Mailliard, J.

1923. Fall field work in Plumas and Yuba counties, California, in 1922. Proc. Calif. Acad. Sci., ser. 4, **13**, 29–41.

1927. The birds and mammals of Modoc County, California. Proc. Calif. Acad. Sci., ser. 4, **16**, 261–359, 1 fig. in text.

Merriam, C. H.

1899. Results of a biological survey of Mount Shasta, California. U. S. Dept. Agr., Div. Biol. Surv., N. Am. Fauna, **16**, 179 pp., 5 pls., 46 figs. in text.

1926. The buffalo in northeastern California. Jour. Mammalogy, **7**, 211–214.

Miller, G. S., Jr.

1897. Revision of the North American bats of the family Vespertilionidae. U. S. Dept. Agr., Div. Biol. Surv., N. Am. Fauna, **13**, 140 pp., 3 pls., 40 figs. in text.

1900. A new subgenus for *Lepus idahoensis*. Proc. Biol. Soc. Wash., **13**, 157.

Nelson, E. W.

1909. The rabbits of North America. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **29**, 1–314, pls. 1–13, 19 figs. in text.

1925. Status of the pronghorned antelope. U. S. Dept. Agr., Dept. Bull. 1346, pp. 1–64, 21 figs. in text.

Newberry, J. S.

1857. Report upon the zoology of the route [from the Sacramento Valley to the Columbia River]. U. S. Pac. R. R. Expl. and Surv., **6**, Part IV, no. 2, pp. 35–110, pls. 26–29.

Oberholser, H. C.

1920. Description of a new *Otocoris* from California. Condor, **22**, 34–35.

Osgood, W. H.

1909. Revision of the mice of the American genus Peromyscus. U. S. Dept. Agr., Bur. Biol. Surv., N. Am. Fauna, **28**, 285 pp., 8 pls., 12 figs. in text.

Ray, M. S.

1915. Nesting of the American osprey at Eagle Lake, California. Condor, **17**, 70–74, 4 illus.

1921. On the occurrence of the buffle-head at Eagle Lake. Condor, **23**, 192–193, figs. 32–33.

Ridgway, R.

1912. Color standards and color nomenclature (Washington, D. C., published by the author), pp. iii + 43 + 1, 53 pls.

1914. The birds of north and middle America. U. S. Nat. Mus. Bull., **50**, Part VI, pp. xx + 882, 36 pls.

Sheldon, H. H.

1907. A collecting trip by wagon to Eagle Lake, Sierra Nevada mountains. Condor, **9**, 185–191.

SNYDER, J. O.
1917. The fishes of the Lahontan system of Nevada and northeastern California. Bull. U. S. Bur. Fisheries, **35**, 33–86, 9 figs. in text, 2 pls., 1 map.

STEJNEGER, L.
1890. On the snakes of the genus Charina. Proc. U. S. Nat. Mus., **13**, 177–182.

SUDWORTH, G. B.
1908. Forest trees of the Pacific slope. U. S. Dept. Agr., Forest Service, 441 pp., 2 pls., 207 figs. in text.

SWARTH, H. S.
1914. The California forms of the genus *Psaltriparus*. Auk, **31**, 499–526, pl. 40.
1920. Revision of the avian genus *Passerella*, with special reference to the distribution and migration of the races in California. Univ. Calif. Publ. Zool., **21**, 75–224, pls. 4–7, 30 figs. in text.
1921. Bubo virginianus occidentalis in California. Condor, **23**, 136.

SWARTH, H. S., and BROOKS, A.
1925. The timberline sparrow a new species from northwestern Canada. Condor, **27**, 67–69.

TAYLOR, W. P.
1909. Two new rodents from Nevada. Univ. Calif. Publ. Zool., **5**, 283–302, pls. 27–29.
1911. Mammals of the Alexander Nevada expedition of 1909. Univ. Calif. Publ. Zool., **7**, 205–307.
1918. Revision of the rodent genus *Aplodontia*. Univ. Calif. Publ. Zool., **17**, 435–504, pls. 25–29, 16 figs. in text.

TEST, F. C.
1898. A contribution to the knowledge of the variations of the tree frog *Hyla regilla*. Proc. U. S. Nat. Mus., **21**, 477–492, 1 pl.

TOWNSEND, C. H.
1887. Field-notes on the mammals, birds and reptiles of northern California. Proc. U. S. Nat. Mus., **10**, 159–241, pl. 5.

TROUESSART, E. L.
1897. Catalogus mammalium tam viventium quam fossilium (Berolini, R. Friedlander und Sohn), **1**, fasc. iii, pp. 644–664.

VAN DENBURGH, J.
1919. Nesting of the western willet in California. Condor, **21**, 39–40.
1922. The reptiles of western North America. Calif. Acad. Sci., Occas. Papers, **10**, vol. 2, pp. 623–1028, pls. 58–128.

VAN ROSSEM, A. J.
1928. A northern race of the mountain chickadee. Auk, **45**, 104–105.

WILLARD, J. M.
1902. Occurrence of the redpoll in California. Condor, **4**, 45–46.

Transmitted August 28, 1929.

INDEX

A

Acanthis linaria linaria, *401*.
Accipiter cooperii, 106, *187*.
  velox, 92, 110, *186*.
Actitis macularia, 92, *219–221*.
Aechmophorus occidentalis, 92, *156–157*.
Aëronautes saxatilis saxatilis, *242*.
Agelaius phoeniceus, 94.
  phoeniceus californicus, 90, 103, 105, *384*.
  phoeniceus nevadensis, 92, 103, 105, *382–384*.
  tricolor, 99, *384*.
Aix sponsa, 90, 99, *174–175*.
Alexander, Miss Annie M., vi, vii, 10, 554.
Allen, Professor and Mrs. James T., 237.
Ambystoma macrodactylum, 21, *138*.
Ammodramus savannarum bimaculatus, *413*.
Amphibians, 136–144.
Amphispiza belli nevadensis, 91, 98, *417*.
  bilineata deserticola, 91, 98, *417–418*.
Anas platyrhynchos platyrhynchos 91, 106, *171–172*.
Anser albifrons albifrons, *170*.
Antelope, prong-horn, *575–577*.
Anthus, 113.
  spinoletta rubescens, 111, 359–360.
Antilocapra americana americana, 92, 98, *575–577*.
Antrozous pallidus pacificus, 100, *457*.
Aphelocoma californica immanis, 90, 101, 102, *296–298*.
Aplodontia rufa californica, 93, 110, *530*.
Aquatic habitats, 17–29.
Aquila chrysaëtos, 92, 106, *190*.
Archilochus alexandri, 91, *242*.
Arctic-Alpine life-zone, 96, 128; plants of, 89.
Ardea herodias hyperonca, 91, 102, *165–166*.
Asio flammeus flammeus, *238*.
  wilsonianus, *238*.
Astur atricapillus, 93, 110, *185*.
Asyndesmus lewisi, 92, *253*.
Austral vertebrates, 96, 98.
Avocet, American, *225*.

B

Badger, California, *467–469*, 479.
Baeolophus inornatus griseus, 91, 102, 105, *312*.
  inornatus inornatus, 90, 102, 105, *310–311*.
Balanosphyra formicivora bairdi, 90, 99, *250–252*.
Baldpate, *172*.
Bassariscus astutus raptor, 91, 100, *462*.
Bat, black-nosed, *456*.
  golden long-eared, *455*.
  interior long-legged, *455*.
  intermediate lump-nosed, *457*.
  large brown, *456–457*, 458.
  Merriam western, *456*.
  Mexican free-tailed, *458*.
  Pacific pallid, *457*.
  silvery-haired, *456*.
  southern little California, *455*.
  Tejon Yuma, *455*.
  western red, *457*.
  Yellowstone little brown, *454*.
Bear, black, 460.
  grizzly, 459, 460.
  Klamath grizzly, *459–460*.
  Sierra Nevada black, *458–459*.
Beaver, Sierra Nevada mountain, *530*.
Bietz, Jacob, 473.
Bighorn, lava beds, 113, *577–578*.
Birds, 154–446; censuses of, 114–126; populations of, 114–126.
Bison bison bison, *577*.
Bison, plains, *577*.
Bittern, American, *167*.
Blackbird, California Brewer, 115, 118, 122, 126, 193, 353, *386–390*.
  California red-winged, 116, *384*.
  Nevada red-winged, 122, *382–384*.
  tri-colored red-winged, *384*.
  yellow-headed, *381–382*.
Bluebird, mountain, 326, *351–353*.
  western Mexican, 63, 64, 117, 119, 120, 121, 124, 326, 330, *349–351*.
Blue chaparral habitat, 40–43.
Bombycilla cedrorum, *360*.
Bonar, Professor Lee, 567.
Book, R. N., 462.
Boreal life-zone, 95; vertebrates of 96, 109, 110, 111, 112, 113.
Borell, Adrey E., vii, 10, 196.
Botaurus lentiginosus, *167*.
Brachylagus, 559, 560, 562.
  idahoensis, 555.
Branta canadensis canadensis, 92, 109, *168–169*.
  canadensis minima, *170*.

Brittan, Harry, 459, 465.
Broad-leafed tree habitats, 58–65.
Brushland habitats, 38–57.
Bubo virginianus occidentalis, 91–102, 105, *234–235*.
  virginianus pacificus, 84, 91, 102, 105, *234*.
Bufo boreas boreas, 93, 109, *139–140*.
  boreas halophilus, 90, *140*.
Building habitat, 85.
Bunting, lazuli, 116, 118, 122, 127, *392–393*.
Bush-tit, California, *312–315*.
  lead-colored, 126, *315–319*.
Buteo borealis calurus, 91, 106, *187–188*.
  lagopus sancti-johannis, *189*.
  lineatus elegans, 90, 99, *188*.
  regalis, *189*.
  swainsoni, 92, *188–189*.
Butorides virescens anthonyi, 99, *166–167*.

C

Californian fauna, 96, 99, 100, 105, 106.
Californian faunal areas, 108, 129.
Callospermophilus chrysodeirus chrysodeirus, 93, 110, 470, *480–483*.
Calypte anna, 43, 91, 99, *242*.
Canadian life-zone, 74, 128; plants of, 88; vertebrate species of, 92–93.
Canis lestes, 92, *471–474*.
  ochropus, 92, *471–474*.
Capella delicata, 92, 110, *218–219*.
Carpodacus cassinii, 93, 110, *397–398*.
  mexicanus frontalis, 91, 106, *398–401*.
  purpureus californicus, 92, 110, *396–397*.
Cat, California ring-tailed, *462*.
Cathartes aura septentrionalis, 91, 106, *183–184*.
Catherpes mexicanus conspersus, 91, 103, 105, *334*.
  mexicanus punctulatus, 91, 103, 105, *334*.
Catoptrophorus semipalmatus inornatus, 91, *222–223*.
Census, areal, 126, 128.
Censuses of birds, 114–126; reason for smallness of, at season of migration, 129; time, 114, 128.
Centrocercus urophasianus, 91, 98, *201–207*.
Ceophloeus pileatus picinus, 93, 110, *249*.
Certhia familiaris zelotes, 93, 110, *327–328*.
Cervus occidentalis, 111.
Chaetura vauxii, 111, *242*.
Chamaea fasciata henshawi, 91, 99, *328–329*.
Chaparral, blue, habitat, 40–43.
  green, habitat, 43–49.
Charina bottae, *149*.
Charitonetta albeola, 93, 111, *178–179*.
Chat, long-tailed yellow-breasted, 115, 116, 118, 294, *378–379*.
Chaulelasmus streperus, *172*.
Check list of terrestrial vertebrates of the Lassen section, 131–136.
Chen hyperboreus hyperboreus, *170*.
Chickadee, mountain, 313.
  short-tailed mountain, 119, 120, 121, 122, 123, 124, 125, 126, 127, *305–310*.
Chickaree, Sierra Nevada, *489–493*.
Chipmunk, Allen, *488–489*.
  Klamath, *486–487*.
  sage-brush, *485–486*.
  Tahoe, *487–488*.
Chlidonias nigra surinamensis, 92, *229*.
Chondestes grammacus strigatus, 91, 106, *414–416*.
Chordeiles acutipennis texensis, 90, 99, *241*.
  minor hesperis, 92, 99, 110, *240*.
Cinclus mexicanus unicolor, 93, 110, *329*.
Circus hudsonius, *192–193*.
Citellus oregonus, 92, 468, *483–485*.
Clemmys marmorata, 90, 99, *154*.
Cnemidophorus tesselatus mundus, 90, 99, *147–148*.
Colaptes cafer collaris, 92, 106, *245–248*.
Collecting stations in the Lassen section, 10–12.
Collins, George, 154.
Collins, L. W., vi.
Coluber constrictor mormon, 90, 102, *149*.
  lateralis, 91, 99, *149*.
Columba fasciata fasciata, 110, *230*.
Colymbus nigricollis californicus, 92, *155–156*.
Condor, California, *184*.
Coniferous tree habitat, 67–75.
Contia tenuis, 90, 99, *151*.
Conies, 470.
Cony, gray-headed, 82, *534–543*.
  Warner Mountains, *543*.
Coon, California, 55, *460–462*.
Coot, North American, 117, 192, *215–216*.
Cormorant, Farallon double-crested, 115, *160–165*.
Corthylio calendula calendula, 359.
  calendula cineraceus, 93, 110, *358–359*.
  calendula grinnelli, 359.

Corvus brachyrhynchos hesperis, 90, 99, *301–303*.
  corax sinuatus, 91, 106, *301*.
Corynorhinus rafinesquii intermedius, 100, *457*.
Crane, sandhill, 63, *213–214*.
Creeper, Sierra Nevada brown, 119, 121, 122, 123, 124, *327–328*.
Crossbill, Bendire Red, 122, 123, *404–405*.
Crotalus oregonus, 92, 102, *153*.
Crow, western American, 86, 115, 116, 117, *301–303*.
Curlew, long-billed, *219*.
Cultivated field habitat, 86–87.
Cyanocephalus cyanocephalus, 98, *303*.
Cyanocitta stelleri frontalis, 93, 110, *293–295*.
Cygnus columbianus, *168*.
Coyote, California valley, *471–474*.
  mountain, *471–474*.

D

Dafila acuta tzitzihoa, *172–173*.
Dale, Creath, vii, 472, 475.
Dale, Mrs. Creath, vii, 460.
Deer, black-tailed, 570, 571, 572, 573.
  Columbian black-tailed, *562–569*.
  mule, 563, 566, 567, 569, 574.
  Rocky Mountain mule, *569–574*.
  western white-tailed, *574*.
Dendragapus obscurus sierrae, 93, 110, *200–201*.
Dendroica aestiva brewsteri, 92, *369–371*.
  auduboni, 371.
  auduboni auduboni, 93, 110, *372–373*.
  coronata hooveri, *371*.
  nigrescens, 92, 106, *373–374*.
  occidentalis, 93, 110, *374–375*.
  townsendi, *374*.
Dipodomys heermanni, 233.
  heermanni californicus, 91, 101, 102, *500–505*.
  heermanni eximius, 504.
  heermanni saxatilis, 91, 100, 101, *505–507*.
  ordii columbianus, 91, 98, *507–508*.
Dipper, northern American, *329*.
Distributional behavior, 107.
Distributional considerations, 14.
Dixon, Joseph, vii, 1, 10.
Dove, mourning, 27.
  western mourning, 115, 116, 126, *230–232*.
Dowitcher, long-billed, *224*.
Dryobates nuttallii, 90, 99, *261*.
  pubescens leucurus, 105, *260*.
  pubescens turati, 90, 105, *260*.
  villosus orius, 93, 110, *257–259*.
Duck, American pintail, *172–173*.
  baldpate, *172*.
  Barrow golden-eye, *177–178*.
  buffle-head, 77, 176, *178–179*.
  canvas-back, *176*.
  lesser scaup, *175*.
  northern ruddy, *180*.
  redhead, *176*.
  ring-necked, *176*.
  shoveller, *174*.
  wood, 63, 64, 115, 116, *174–175*, 464.
Dunlin, red-backed, *224*.

E

Eagle, bald, 20, 77.
  southern bald, *190–192*.
  golden, 126, *190*.
Eagle Lake, history of, 18, 21.
Ecologic niches, 97.
Elanus leucurus majusculus, 99, *185*.
Elk, 113.
Empidonax difficilis difficilis, 91, *281–282*.
  griseus, 91, 98, *281*.
  hammondii, 93, 110, *273–275*.
  traillii brewsteri, 92, *272–273*.
  wrightii, 93, 110, *275–280*.
Eneboe, Cyril E., 465.
Ensatina sierrae, 92, 110, *139*.
Eptesicus fuscus fuscus, 92, *456–457*.
Erethizon epixanthum epixanthum, 92, 110, *531–534*.
Ereunetes mauri, *224*.
Erismatura jamaicensis rubida, *180*.
Eumeces skiltonianus, 92, 99, *148*.
Euphagus cyanocephalus minusculus, 92, 106, *386–390*.
Eutamias amoenus amoenus, 93, 110, *486–487*.
  minimus pictus, 92, 98, *485–486*.
  senex, 93, 110, *488–489*.
  speciosus frater, 93, 110, 112, *487–488*.
Evotomys mazama, 93, 111, *522*.

F

Factors accounting for habitat limitations, 15.
Falco columbarius bendirei, *197*.
  columbarius richardsonii, *196*.
  mexicanus, 106, *196*.
  peregrinus anatum, 83, *196*.
  sparverius phalaena, 91, 106, *197–199*.
Falcon, prairie, *196*.
Fauna, Californian, 96, 99, 100, 105, 106.
Faunal areas, Californian, 108, 129; divisions, 96; relations, 97–114.
Felis oregonensis californica, 92, *475*.
Field-days, 10.

Field work, objects of, 2.
Finch, California purple, 119, 121, 122, 123, *396–397*.
  Cassin purple, 120, 121, 122, 123, 124, 125, 126, *397–398*.
  rosy, 96.
Fisher, C. O., 494, 573, 574, 577.
Fisher, Pacific, *463*.
Fishes, 19.
Flicker, Monterey red-shafted, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, *245–248*.
Flycatcher, ash-throated, 64.
  gray, *281*.
  greater olive-sided, 120, 121, 123, 125, 127, *283–284*.
  Hammond, 121, 122, 123, 125, *273–275*.
  northern ash-throated, 115, 116, 126, *270*.
  western Traill, 118, 121, 122, *272–273*.
  Wright, 120, 121, 122, 123, 127, *275–280*.
  yellow-bellied western, 124, *281–282*.
Forest land habitats, 67–78.
Fox, California gray, *470–471*.
  red, 471.
  Sierra Nevada red, *469–470*.
Frog, California red-legged, *143*.
  California yellow-legged, *143*.
  Sierra Nevada yellow-legged, *143*.
  western spotted, *144*.
Fulica americana americana, *215–216*.

G

Gadwall *172*.
Gaps, 113; significance of, 97, 112.
Gavia immer, 93, 111, *154–155*.
Gerrhonotus palmeri, 93, 99, 110, *146–147*.
  scincicauda scincicauda, 90, 99, *147*.
Glaucidium gnoma californicum, *235*.
Glaucionetta islandica, 93, 110, *177–178*.
Glaucomys sabrinus lascivus, 93, 110, *495*.
Geococcyx californianus, 90, 99, *232*.
Geologic features of the region, 5.
Geothlypis trichas occidentalis, 91, 106, *377–378*.
Gnatcatcher, western blue-gray, 115, *355–356*.
Goldfinch, green-backed, 478.
  green-backed Arkansas, 115, 117, 118, 123, *403–404*.
  willow American, 115, 116, 117, 118, *402–403*, 404.
Goose, cackling, 170.
  cackling Canada, 115, *170*.
  Canada, 170.
  common white-fronted, *170*.
  honker Canada, 124, *168–169*.
  lesser snow, 116, *170*.
Gopher, pocket, 461.
  Dalles pocket, *497*.
  Red Bluff pocket, *496–497*.
  Sierra Nevada pocket, *497–499*.
  white-toothed pocket, *496*.
Goshawk, American, 121, *185*.
Grazing, effects of, 33, 34, 36.
Great Basin, 96, 97; fauna of, 100, 102, 105, 106; faunal areas, 108; faunal district, 107; region, 22.
Grebe, American eared, *155–156*.
  northern pied-billed, *157*.
  western, *156–157*.
Green chaparral habitat, 43–49.
Grinnell, Hilda W., vii.
Grinnell, Joseph, vii, 1, 10.
Grizzly, 459, 460.
  Klamath, *459–460*.
Grosbeak, California blue, 116, *392*.
  evening, 197.
  Pacific black-headed, 115, 116, 118, 121, 123, *391*.
  Pacific evening, 123, 124, 126, *394–396*.
Grouse, Sierra dusky, 122, *200–201*.
Grus canadensis tabida, *213–214*.
Guiraca caerulea salicarius, 90, 99, *392*.
Gull, California, 159, 164, *226–227*.
  ring-billed, *227*.
Gymnogyps californianus, *184*.

H

Habitats classified, 16; human-made, 85–87; limitations, in Lassen section, 15; limitations, factors accounting for, 15.
Haliaeëtus leucocephalus alascanus, 192.
  leucocephalus leucocephalus, 92, *190–192*.
Harding, Professor S. T., 21.
Hawk, American duck, *196*.
  American rough-legged, 126, *189*.
  Cooper, 124, *187*.
  duck, 83.
  ferruginous rough-legged, *189*.
  marsh, *192–193*.
  red-bellied red-shouldered, 116, *188*.
  Richardson pigeon, *196*.
  sharp-shinned, 117, 119, *186*.
  sparrow, 64.
  Swainson, 125, *188–189*.
  western pigeon, *197*.
  western red-tailed, 116, 117, 118, 119, 122, *187–188*.
  western sparrow, 115, 116, 117, 118, 119, 126, *197–199*.
Hen, sage, 27, 54, 126, *201–207*.
Henshaw, Henry W., 130.

Heron, American black-crowned night, 115, *167*.
  Anthony green, 115, *166–167*.
  California great blue, 115, *165–166*.
Hesperiphona vespertina brooksi, 93, 110, *394–396*.
  vespertina californica, 395.
Hirundo rustica erythrogaster, 90, 106, *290–291*.
Historical comment, 129–130.
Hoffmann, Ralph, 267.
Horne, William R., 571, 572, 574, 576, 578.
Hudsonian life-zone, 128; plants of, 89; vertebrate species of, 92–93.
Huey, L. M., 504.
Human use of mountain meadows, 34.
Hummingbird, Anna, 43, *242*.
  black-chinned, 118, *242*.
  Calliope, 120, 122, 125, 127, *243–245*.
  rufous, *243*.
Hunt, Richard, vii, 10, 410.
Hydroprogne caspia imperator, *228*.
Hyla regilla, 92, *140–143*.
Hylocichla guttata guttata, *344*.
  guttata sequoiensis, 93, 110, *345–348*.
  ustulata swainsoni, 349.
  ustulata ustulata, 92, 110, *348–349*.
Hythergraphs, 7, 8, 9, 107.

I

Ibis, white-faced glossy, *167*.
Icteria virens longicauda, 91, 106, *378–379*.
Icterus bullockii, 91, 106, *385–386*.
Iridoprocne bicolor, 92, *287–289*.
Ixoreus naevius meruloides, *344*.
  naevius naevius, *343*.

J

Jay, blue-fronted Steller, 118, 119, 120, 121, 122, 124, 125, *293–295*.
  California, 63.
  Canada, 113.
  gray, 295.
  interior California, 115, 116, 117, 118, 119, 126, *296–298*.
  piñon, *303*.
Jepson, Willis L., 13.
Jewett, Stanley G., 556.
Junco, eastern slate-colored, *418*.
  northwestern Oregon, *418*.
  Oregon, 117, 120.
  Shufeldt Oregon, *419*.
  Sierra Nevada Oregon, 117, 119, 120, 121, 123, 124, 125, *419–423*.
Junco hyemalis hyemalis, *418*.
  oreganus oreganus, *418*.
  oreganus shufeldti, *419*.
  oreganus thurberi, 93, 110, *419–423*.
Juniper tree habitat, 65–67.

K

Kellogg, Miss Louise, vi, vii, 10, 555.
Killdeer, 287.
  northern, 115, 116, 121, *216–218*.
Kingbird, western, 115, 116, 118, *268–269*.
Kingfisher, western belted, 116, 117, 118, *245*.
Kinglet, golden-crowned, 124, 125, 313.
  ruby-crowned, 72, 294.
  western golden-crowned, *357*.
  western ruby-crowned, 117, 119, 120, 121, 122, 123, 125, 126, 127, *358–359*.
Kite, North American white-tailed, *185*.
Kramer, A. H., 185.

L

Lamb, Chester C., vii, 10.
Lampropeltis getulus boylii, 90, 99, *151*.
Lanius borealis invictus, *360*.
  ludovicianus gambeli, 91, 101, 102, *361–363*.
Lark, dusky horned, *285–287*.
  ruddy horned, 79, 117, *281–285*.
Larus californicus, 92, 98, *226–227*.
  delawarensis, *227*.
Lasionycteris noctivagans, 92, 110, *456*.
Lassen Peak before and after eruption, 6; glaciation of, 5; as related to adjacent territory, 4.
Lassen section, climate of, 7–9; habitat limitations in, 15; check list of terrestrial vertebrates of, 131–136; life-zones of, 88–97; map of, opp. 2.
Lee, W. J., 576.
Lepus californicus, 558, 561.
  californicus californicus, 91, 104, 105, *545–548*.
  californicus vigilax, 547.
  californicus wallawalla, 91, 104, 105, *549–550*.
  townsendii townsendii, 92, *544*.
  washingtonii klamathensis, 93, 110, *544–545*.
Leucosticte, 113.
  tephrocotis, 111.
Life-zones of the Lassen section, 88–97; map of, opp. 2; list of terrestrial vertebrates of, 90.
Limnodromus griseus scolopaceus, *224*.
Linnet, California, 115, 116, 118, 126, *398–401*.
Lion, California mountain, *475*.
Linsdale, Jean M., vii, 1, 10.
Literature cited, 579–582.

Lizard, California alligator, *147*.
  California whip-tailed, *147–148*.
  leopard, 79.
  Pacific blue-bellied, *145–146*.
  northern brown-shouldered, *144*.
  Sierra alligator, *146–147*.
  whip-tailed, 38.
Lobipes lobatus, *226*.
Logging, effects of, 69.
Loomis, B. F., vii, 5, 6, 76, 82, 83, 467.
Loon, common, *154–155*.
Lophortyx californica vallicola, 90, 101, 102, *208–210*.
Low vegetation habitats, 29–38.
Lower Sonoran life-zone, 93, 94; plants of, 88; vertebrate species of, 90–92.
Loxia curvirostra bendirei, 93, 110, *404–405*.
Lutra canadensis brevipilosus, 91, *465*.
Lynx rufus californicus, 91, 105, *475*.
  rufus pallescens, 92, 105, *475*.

M

Magpie, American black-billed, 126, 159, *298–299*.
  yellow-billed, 54, 86, 115, 117, *299–300*.
Mailliard, Joseph, 281.
Mallard, common, *171–172*.
Mammals, 446–578.
Map, showing position of Lassen section, v; sagittal section through the Lassen section, 3; of life-zones, opp. 2.
Mareca americana, *172*.
Marmot, Sierra, 80.
  yellow-bellied, *476–477*.
Marmota flaviventer flaviventer, 92, 110, 112, *476–477*.
Marsh habitat, 29–32.
Marten, Sierra pine, *462–463*.
Martes caurina sierrae, 93, 110, *462–463*.
  pennanti pacifica, 110, *463*.
Martin, northern purple, 116, *293*.
  purple, 64.
Materials, 8.
Meadow habitat, 32–34; mountain, human use of, 34.
Meadow-lark, western, 27, 115, 116, 117, 119, 122, 126, *380–381*.
Megaceryle alcyon caurina, 91, *245*.
Mephitis occidentalis major, 92, 104, 105, *467*.
  occidentalis occidentalis, 91, 104, 105, *466*.
Merganser, American, 77, 116, 160, 177, *180–183*.
Mergus americanus, 92, 110, *180–183*.
Merriam, C. Hart, 88, 94, 577.
Microdipodops californicus, 509.
  megacephalus oregonus, 91, 98, *509–510*.
Microlagus, 559, 560, 562.
Microtus californicus, 233.
  californicus eximius, 91, 100, *524–526*.
  montanus yosemite, 92, *522–524*.
  mordax mordax, 92, 111, *526–527*.
  mordax sierrae, 93, 110, 111, 527, *527–528*.
Miller, Professor Loye, 138, 185.
Mimus polyglottos leucopterus, 106, *336–337*.
Mink, 164.
  Pacific, *464*.
Mockingbird, 87.
  western, *336–337*.
Moffitt, James, 156, 157, 169, 228, 229.
Mole, 57.
  central California, *446–447*.
  Klamath California, *447–449*.
Mouse, Allen jumping, *531*.
  Boyle white-footed, *513*.
  cantankerous meadow, *526–527*.
  Coues pocket, *500*.
  desert harvest, *510*.
  Gambel white-footed, *511–513*.
  Gilbert white-footed, *514*.
  gray grasshopper, 37–38, *510*.
  house, *530*.
  Idaho cañon, *511*.
  kangaroo, 37.
  long-tailed harvest, *510–511*.
  Mazama red-backed, *522*.
  meadow, 193.
  Oregon kangaroo, *509–510*.
  Sanhedrin meadow, *524–526*.
  Sierra Nevada meadow, *527–528*.
  True white-footed, *513*.
  Yosemite meadow, *522–524*.
Mueller, C. S., 235, 238, 303.
Mus musculus, 91, *530*.
Muskrat, Nevada, *528–529*.
Mustela arizonensis, 92, *463–464*.
  muricus, 93, 110, 112, *463*.
  vison energumenos, 91, 110, *464*.
Myadestes townsendi, 93, 110, *353–355*.
Myiarchus cinerascens cinerascens, 90, 106, *270*.
Myiochanes virens richardsonii, 92, 110, *282–283*.
Myotis californicus californicus, 92, 110, *455*.
  evotis chrysonotus, 93, *455*.
  lucifugus carissima, 93, 110, *454*.
  subulatus melanorhinus, 91, 98, *456*.
  volans interior, 110, *455*.
  yumanensis sociabilis, 91, *455*.

N

Nannus hiemalis pacificus, *331.*
Neotoma cinerea occidentalis, 92, 111, *517–521.*
  fuscipes streatori, 84, 91, 100, *516–517.*
  intermedia desertorum, 515.
  intermedia nevadensis, 91, 98, *515–516.*
Nettion carolinense, *173.*
Neürotrichus gibbsii gibbsii, 93, 111, *449.*
Newberry, J. S., 129, 459.
Newt, Pacific coast, 24, *136–138.*
Nighthawk, Pacific Virginia, *240.*
  Texas sharp-winged, *241.*
Nordquist, Gus, 566.
Nucifraga columbiana, 93, 110, *304.*
Numenius americanus, *219.*
Nutcracker, Clark, 123, 124, 125, *304.*
Nuthatch, northern pigmy, 121, *325–327.*
  pigmy, 330.
  red-breasted, 120, 121, 122, 123, 124, 125, *322–324.*
  Rocky Mountain white-breasted, 125, *321–322.*
  slender-billed white-breasted, 115, 117, 118, 119, 120, *319–321.*
  white-breasted, 64.
Nuttallornis mesoleucus majorinus, 93, 110, *283–284.*
Nycteris borealis teliotis, 99, *457.*
Nycticorax nycticorax naevius, 106, *167.*
Nyroca americana, *176.*
  affinis, *175.*
  collaris, *176.*
  valisineria, *176.*

O

Oberholseria chlorura, 92, *406–407.*
Objects of field work, 2.
Ochotona schisticeps schisticeps, 82, 93, 110, 111, *534–543.*
  schisticeps taylori, 79, 91, 111, *543.*
Odocoileus columbianus columbianus, 93, *562–569.*
  hemionus hemionus, 92, *569–574.*
  virginianus macrourus, 91, *574.*
Ondatra zibethica mergens, 92, 98, *528–529.*
Onychomys leucogaster fuscogriseus, 91, 98, *510.*
Oporornis tolmiei, 93, 110, *376.*
Orchard habitat, 87.
Oreortyx picta picta, 93, 110, *210–213.*
Oriole, Bullock, 115, 116, *385–386.*
Oroscoptes montanus, 91, 98, *339–341.*
Osprey, 77, 190, 192.
  American, *193–195.*
Otocoris alpestris, 94.
  alpestris merrilli, 92, 102, 105, *285–287.*
  alpestris rubea, 79, 90, 102, 105, *284–285.*
  alpestris sierrae, 286.
Otospermophilus douglasii, 82, 91, 100, *477–479.*
Otter, California river, *465.*
Otus asio quercinus, 90, 99, *233.*
Ovis canadensis, 111.
  canadensis californiana, 91, *577–578.*
Owl, American barn, *232–233.*
  American long-eared, *238.*
  barn, 451.
  California pigmy, *235.*
  California spotted, *237.*
  great horned, 196.
  northern burrowing, *235–237.*
  northern short-eared, *238.*
  Pacific great horned, 84, *234.*
  pallid great horned, *234–235.*
  screech, 64.
  Southern California screech, *233.*
Oxyechus vociferus vociferus, 91, 106, *216–218.*

P

Pandion haliaëtus carolinensis, 92, *193–195.*
Passer domesticus domesticus, 91, 106, *393.*
Passerculus sandwichensis alaudinus, 411, *412.*
  sandwichensis anthinus, *411.*
  sandwichensis nevadensis, 92, *412–413.*
  sandwichensis sandwichensis, *411.*
Passerella iliaca altivagans, *440.*
  iliaca annectens, *445.*
  iliaca fulva, 93, 111, *440–441.*
  iliaca mariposae, 93, 110, 111, *441–444.*
  iliaca megarhynchus, *445.*
  iliaca sinuosa, *446.*
  iliaca schistacea, *440.*
  iliaca unalaschcensis, *446.*
  lincolnii gracilis, 435.
  lincolnii lincolnii, 93, 110, *433–435.*
  melodia fisherella, 92, 103, 105, *436–439.*
  melodia mailliardi, 92, 103, 105, *435–436.*
  melodia merrilli, *439.*
  melodia morphna, *439–440.*
Passerina amoena, 91, 106, *392–393.*
Pelecanus erythrorhynchos, 92, *157–160.*
Pelican, 298.
  American white, 115, 116, *157–160.*
Pelidna alpina sakhalina, *224.*

Penthestes gambeli abbreviatus, 93, 110, *305–310*.
gambeli gambeli, 310.
gambeli grinnelli, 310.
Perisoreus, 113.
canadensis, 295.
obscurus griseus, 111, 295.
Perognathus parvus mollipilosus, 91, 98, 237, *500*.
Peromyscus boylii boylii, 91, 100, *513*.
crinitus crinitus, 91, 98, *511*.
maniculatus gambelii, 92, 449, *511–513*.
maniculatus sonoriensis, 513.
truei gilberti, 91, 104, 105, *514*.
truei truei, 91, 104, 105, *513*.
Petrochelidon albifrons albifrons, 84, 91, 106, *291–293*.
Pewee, western wood, 115, 116, 118, 120, 121, 122, 123, 124, 125, 127, *282–283*.
Phainopepla nitens lepida, *360*.
Phainopepla, northern, *360*.
Phalacrocorax auritus albociliatus, 92, *160–165*.
Phalaenoptilus nuttallii californicus, 91, 101, 102, *238–239*.
Phalarope, northern, *226*.
Wilson, 225.
Phenacomys, 113.
intermedius intermedius, 111.
Phoebe, northern black, 117, *271–272*.
northern Say, *271*.
Rocky Mountain Say, *270–271*.
Pica nuttallii, 90, 105, *299–300*.
pica hudsonia, 91, 105, 300, *298–299*.
Picoides arcticus, 93, 110, *265–268*.
arcticus tenuirostris, 267.
Pigeon, northern band-tailed, *230*.
Pintail, American, *172–173*.
Pipilo fuscus carolae, 91, 99, *410–411*.
maculatus curtatus, 103, 105, *409–410*.
maculatus falcinellus, 91, 103, 105, *408–409*.
Pipistrellus hesperus merriami, 90, 99, *456*.
Pipit, 96.
American water, 117, *359–360*.
Piranga ludoviciana, 93, 110, *390–391*.
Pisobia bairdii, *223*.
minutilla, *223–224*.
Pituophis catenifer deserticola, 91, 105, *150*.
catenifer heermanni, 90, 105, *150*.
Plants of the Lassen section, 12–14.
Plegadis guarauna, *167*.
Podilymbus podiceps podiceps, 92, *157*.
Polioptila caerulea amoenissima, 91, 99, *355–356*.
Pooecetes gramineus affinis, *414*.
gramineus confinis, 91, 98, *414*.
Poor-will, dusky, *238–239*.
Populations of birds, 114–126.
Porcupine, yellow-haired, *531–534*.
Porzana carolina, *215*.
Prairie habitat, 34–36.
Procyon lotor psora, 55, 92, 102, *460–462*.
Progne subis subis, 91, 102, *293*.
Psaltriparus minimus californicus, 90, 103, 105, *312–315*.
minimus plumbeus, 91, 103, 105, *315–319*.

Q

Quail, interior mountain, 119, 120, 123, 127, *210–213*.
interior valley, 115, 116, 117, 118, 119, *208–210*.
valley, 27, 186.
Querquedula cyanoptera, 91, *174*.
discors, *173*.

R

Rabbit, brush, 51, 562.
California brush, *551–552*, 558.
California jack, *545–548*.
cottontail, 153.
Idaho pigmy, *553–562*.
jack, 234.
Oregon snowshoe, *544–545*.
pigmy, 53, 558.
Sacramento cottontail, *551*.
snowshoe, 475.
Washington cottontail, *550*.
Washington jack, *549–550*.
western white-tailed jack, *544*.
Racer, California striped, *149*.
western yellow-bellied, *149*.
Rail, Pacific Virginia, *214*.
sora, *215*.
Rain-pool habitat, 17, 20.
Rallus virginianus pacificus, 92, *214*.
Rana aurora draytonii, 91, 99, *143*.
boylii boylii, 91, 99, *143*.
boylii sierrae, *143*.
pretiosa pretiosa, 93, 111, *144*.
Rat, bushy-tailed wood, 67, 470.
Columbian kangaroo, 37, *507–508*.
desert wood, 515.
kangaroo, 78.
Nevada wood, *515–516*.
northern California kangaroo, *500–505*.
roof, *529*.
stony-ground kangaroo, *505–507*.
Streator wood, 51, 84, *516–517*.
western bushy-tailed wood, *517–521*.
Rattlesnake, Pacific, *153*.
Rattus rattus alexandrinus, *529*.
Raven, western, *301*.
Recurvirostra americana, *225*.
Redpoll, common, *401*.
Region described, 4.

Regulus satrapa olivaceus, 93, 110, *357*.
Reithrodontomys megalotis, 233.
  megalotis longicaudus, 91, 104, 105, *510–511*.
  megalotis megalotis, 91, 104, 105, *510*.
Reptiles, 144–154.
Road habitat, 85–86.
Road-runner, California, *232*.
Robin, 63, 141, 197.
  western, 118, 120, 121, 122, 123, 124, 125, *341–343*.
Rock land habitats, 78–85.
Rocky-plain habitat, 78–79.
Rocky-slope habitat, 79–85.
Rubber-snake, 149.
Running water habitat, 23–29.

S

Sage-brush habitat, 52–57, 128.
Sage hen, 27, 54, 126, *201–207*.
Salamander, long-toed, *138*.
  Sierra Nevada, *139*.
Salpinctes obsoletus obsoletus, 92, 106, *334–336*.
Sand-dune habitat, 37–38.
Sandpiper, Baird, *223*.
  least, 223, *223–224*.
  spotted, 115, 116, 121, 125, *219–221*.
  western, *224*.
  western solitary, *222*.
Sapsucker, Pacific Williamson, 124, 125, *256*.
  red-naped yellow bellied, *254*.
  Sierra Nevada red-breasted, 121, 124, *251–255*.
Sayornis nigricans semiatra, 90, 99, *271–272*.
  saya saya, *270–271*.
  saya yukonensis, *271*.
Scapanus latimanus dilatus, 92, 104, 105, *447–449*.
  latimanus latimanus, 90, 104, 105, *446–447*, 449.
Scaphiopus hammondii, 91, 98, *139*.
Sceloporus graciosus gracilis, 92, 109, 146, *144–145*.
  occidentalis occidentalis, 90, 100, 102, *145–146*.
Sciurus douglasii albolimbatus, 93, 110, *489–493*.
  griseus griseus, 91, 100, *494–495*.
Scrub oak habitat, *50–52*.
Selasphorus rufus, *243*.
Sheep, mountain, 113, 577–578.
Sheldon, Harry H., 130, 176, 575.
Shoveller, *174*.
Shrew, California long-tailed, *451–452*.
  mountain water, *452–454*.
  Sierra Nevada wandering, *451*.
  Yosemite Trowbridge, *450*.
Shrew-mole, Gibbs, *449*.
Shrike, California loggerhead, *361–363*.
  northwestern boreal, *360*.
Sialia currucoides, 92, 110, *351–353*.
  mexicana occidentalis, 92, 110, *349–351*.
Sifford, A., 563.
Siskin, northern pine, 122, 123, 125, *401–402*.
Sitta canadensis, 93, 110, *322–324*.
  carolinensis aculeata, 90, 103, 105, *319–321*.
  carolinensis nelsoni, 93, 103, 105, *321–322*.
  pygmaea pygmaea, 92, 110, *325–327*.
Skink, western, *148*.
Skunk, California spotted, *465–466*.
  Great Basin spotted, *465*.
  Great Basin striped, *467*.
  northern California striped, *466*.
Snake, Boyle king, *151*.
  coast garter, *151*.
  desert gopher, *150*.
  elegant garter, *152*.
  garter, 141.
  giant garter, *151*.
  Pacific garter, *152–153*.
  rubber, *149*.
  sharp-tailed, *151*.
  valley gopher, *150*.
Snipe, Wilson, 118, 126, *218–219*.
Solitaire, Townsend, 121, 122, 123, 124, 125, 126, *353–355*.
Sorex ornatus, 233.
  ornatus californicus, *451–452*.
  palustris navigator, 93, 110, *452–454*.
  trigonirostris, 452.
  trowbridgii mariposae, 93, 110, *450*, 452.
  vagrans amoenus, 93, 110, *451*.
Sparrow, Alberta fox, *440*.
  Aleutian Savannah, *411*.
  black-throated, 78.
  Brewer, 126, *425–427*.
  desert black-throated, *417–418*.
  English house, *393*.
  Gambel white-crowned, *432–433*.
  golden-crowned, 117, 119, 120, *428–430*.
  Hudsonian white-crowned, 125, *430–431*.
  Kodiak Savannah, *411*.
  Merrill song, *439*.
  Modesto song, 116, 118, 120, 123, *435–436*.
  Modoc song, *436–439*.
  Nevada sage, *417*.
  Nevada Savannah, *412–413*.
  northeastern Lincoln, 120, 123, 125, *433–435*.

  Oregon vesper, *414.*
  Pacific chipping, 120, 122, 123, 125, 126, 127, *423–425.*
  Puget Sound white-crowned, *433.*
  rusty song, 117, *439–440.*
  Savannah, 117, 186.
  Shumagin fox, *446.*
  slate-colored fox, *440.*
  song, 119.
  thick-billed fox, *445.*
  Valdez fox, 119, *446.*
  Warner Mountains fox, *440–441.*
  western grasshopper, *413.*
  western lark, 115, 117, 122, *414–416.*
  western Savannah, *412.*
  western vesper, *414.*
  Yakutat fox, 119, *445.*
  Yosemite fox, 120, 121, 122, 123, 124, 126, 127, *441–444.*
Spatula clypeata, *174.*
Speciation, processes concerned with, 129.
Specimens collected, 12.
Speotyto cunicularia hypugaea, 90, 106, *235–237.*
Sphyrapicus thyroideus thyroideus, 93, 110, *256.*
  varius daggetti, 93, 110, *254–255.*
  varius nuchalis, *254.*
Spilogale gracilis saxatilis, 105, *465.*
  phenax phenax, 91, 105, *465–466.*
Spinus pinus pinus, 93, 110, *401–402.*
  psaltria hesperophilus, 91, 106, *403–404.*
  tristis salicamans, 91, 99, *402–403.*
Spizella breweri, 91, *425–427.*
  passerina stridula, 92, 110, *423–425.*
  taverneri, 427.
Squirrel, antelope ground, 78.
  California gray, *494–495.*
  Douglas ground, 82, *477–479,* 535.
  golden-mantled ground, 185, 463, 484, 490.
  gray, 64.
  Oregon ground, 189, 467, 468, *483–485.*
  Sierra golden-mantled ground, *480–483.*
  Sierra Nevada flying, *495.*
Standing water habitat, 17–23; types of, 23.
Statistics, 10, 12.
Steganopus tricolor, 92, *225.*
Stelgidopteryx ruficollis serripennis, 90, 106, *289–290.*
Stellula calliope, 93, 110, *243–245.*
Sterna forsteri, 92, *228.*
Storer, Tracy I., vii, 10.
Streamside thicket habitat, 38, 41.
Strix occidentalis occidentalis, *237.*
Stub-forest habitat, 75–78.
Sturnella neglecta, 91, 106, *380–381.*
Succession of habitats, 48.
Swallow, American barn, *290–291.*
  cliff, 84, 234.
  northern cliff, *291–293.*
  northern rough-winged, 116, *289–290.*
  northern violet-green, *287.*
  tree, 64, 77, 115, 116, *287–289,* 326, 330.
  violet-green, 64.
Swan, whistling, *168.*
Swarth, Harry S., vii, 10.
Swift, mountain, *144–145.*
  northern white-throated, *242.*
  Vaux, *242.*
Sylvilagus audubonii, 233.
  audubonii audubonii, 90, 105, *551.*
  audubonii baileyi, 556.
  bachmani, 233.
  bachmani bachmani, 91, 105, *551–552,* 560.
  bachmani cinerascens, 558, 561.
  bachmani mariposae, 552.
  bachmani ubericolor, 552.
  bachmani virgulti, 558.
  idahoensis, 91, 105, *553–562.*
  nuttallii, 557, 561.
  nuttallii grangeri, 560.
  nuttallii nuttallii, 92, 105, *550.*

T

Tachycineta thalassina lepida, 92, *287.*
Tadarida mexicana, 91, 100, *458.*
Tamias lateralis, 470.
Tanager, western, 120, 122, 123, 124, 125, 126, 127, 294, *390–391.*
Taxidea taxus neglecta, 92, 106, *467–469.*
Taylor, Walter P., vii, 10.
Teal, blue-winged, *173.*
  cinnamon, 116, *174.*
  green-winged, *173.*
Telmatodytes palustris plesius, 92, 98, *332–334.*
Tern, American black, *229.*
  black, 189.
  Coues Caspian, *228.*
  Forster, *228.*
Terrestrial vertebrates of the Lassen section, check list of, 131–136.
Thamnophis ordinoides atratus, 90, 102, *151.*
  ordinoides couchii, 91, 102, 105, *151.*
  ordinoides elegans, 92, 102, 105, *152.*
  sirtalis infernalis, 91, 99, *152–153.*
Thomomys bottae, 94, 233.
  bottae leucodon, 92, 99, 100, *496.*
  bottae navus, 90, 99, 100, *496–497.*
  monticola monticola, 93, 99, 110, *497–499.*
  quadratus quadratus, 92, 98, 99, *497.*

Thrasher, California, 52.
  sage, *339–341.*
  Sonoma California, 115, *337–339.*
Thrush, Alaska hermit, 117, *344.*
  coast varied, *343.*
  northern varied, 118, *344.*
  russet-backed, 118, *348–349.*
  Sierra hermit, 120, 123, 125, *345–348.*
Thryomanes bewickii drymoecus, 91, 101, 102, *331–332.*
Titmouse, California plain, 115, 116, 117, 118, 119, 120, *310–311.*
  gray plain, 126, *312.*
  plain, 64.
Toad, California, *140.*
  northwestern, *139–140.*
  western spadefoot, *139.*
Totanus melanoleucus, *223.*
Towhee, green-tailed, 120, 126, 127, *406–407.*
  Nevada spotted, *409–410.*
  Sacramento brown, 115, 116, 119, *410–411.*
  Sacramento spotted, 116, 117, 119, 120, *408–409.*
  spotted, 294.
Townsend, Charles H., 130, 470.
Toxostoma redivivum sonomae, 91, 99, *337–339.*
Transition life-zone, 128; plants of, 88; vertebrates of, 91–93.
Tree-toad, Pacific, *140–143.*
Tringa solitaria cinnamomea, *222.*
Triturus torosus, 24, 91, *136–138.*
Troglodytes aedon parkmanii, 91, 106, *329–331.*
Turdus migratorius propinquus, 92, 110, *341–343.*
Turner, Coyle, 546.
Turtle, Pacific mud, *154.*
Tyrannus verticalis, 90, 106, *268–269.*
Tyto alba pratincola, 90, 106, *232–233,* 451.

U

Upper Sonoran life-zone, 94, 107, 128; plants of, 88; vertebrate species of, 90–92.
Urocyon cinereoargenteus californicus, 91, 100, *470–471.*
Ursus americanus californiensis, 93, 110, *458–459.*
  klamathensis, *459–460.*
Uta stansburiana stansburiana, 91, 98, *144.*

V

Vermivora celata lutescens, 92, 110, *368–369.*
  ruficapilla gutturalis, 92, 110, *367–368.*
Vireo bellii pusillus, 90, 99, *363–364.*
  gilvus swainsonii, 92, *366–367.*
  solitarius cassinii, 92, 110, *364–365.*
Vireo, Cassin solitary 118, 120, 122, 123, 124, *364–365.*
  least Bell, 115, 116, 118, *363–364.*
  western warbling, 115, 116, 118, 120, 121, 122, 123, *366–367.*
Volcanic action as affecting animal life, 6, 48, 49, 83, 335.
Vulpes fulva necator, 93, 110, *469–470.*
  fulvus argentatus, 470.
Vulture, northern turkey, 115, 116, 117, 121, 126, *183–184.*
  turkey, 58, 166.

W

Warbler, Alaska myrtle, *371.*
  Alaska pileolated, *380.*
  Audubon, 323.
  black-throated gray, 126, *373–374.*
  Calaveras Nashville, 122, *367–368.*
  California yellow, 115, 116, 118, 120, 122, 123, 127, *369–371.*
  hermit, 120, 121, 122, 123, 127, *374–375.*
  golden pileolated, 120, 121, 122, 123, 124, *380.*
  lutescent orange-crowned, 123, *368–369.*
  Pacific Audubon, 117, 120, 121, 122, 123, 124, 125, 126, *372–373.*
  Tolmie, 120, 121, 122, 123, 126, 127, *376.*
  Townsend, *374.*
  yellow, 364.
Water shrew, mountain *452–454.*
Waxwing, cedar, 63, 115, *360.*
Weasel, mountain, *463–464.*
  Sierra least, *463.*
Webb, S. A., 159, 464, 529.
Wells, Ted, 168, 201, 458, 462, 465, 469, 471, 472, 494, 546.
Wieslander, A. E., 89.
Wildcat, California, *475.*
  pallid, *475.*
Willard, J. M., 235, 343, 360, 401, 402, 500.
Willet, western, *222–223.*
Wilson, Leo K., vii, 10.
Wilsonia pusilla chryseola, 93, 110, *380.*
  pusilla pileolata, *380.*
Woodchuck, 476.
Woodland habitats, 58–67.
Woodpecker, Arctic three-toed, 125, *265–268.*
  California, 63, 87.
  California acorn-storing, 115, 116, 117, 118, 119, 120, *250–252.*
  hairy, 77.
  Lewis, 77, 118, 119, 122, *253.*

  Modoc hairy, 120, 121, 124, 125, *257–259.*
  northern white-headed, 121, 122, 123, 124, *261–265.*
  Nuttall ladder-backed, 115, 116, 117, 119, *261.*
  Rocky Mountain downy, *260.*
  western pileated, 124, 125, *249.*
  willow downy, 118, 119, *260.*
Wren, dotted cañon, *334.*
  house, 64, 77, 326, 356.
  Nevada cañon, *334.*
  northern rock, 118, 123, 125, 126, *334–336.*
  rock, 78.
  Sacramento Bewick, 115, 116, 117, 119, 126, *331–332.*
  western house, 115, 116, 118, *329–331.*
  western marsh, *332–334.*
  western winter, *331.*
Wren-tit, pallid, 119, *328–329.*

X

Xanthocephalus xanthocephalus, 92, *381–382.*
Xenopicus albolarvatus albolarvatus, 93, 110, *261–265.*

Y

Yellow-legs, greater, *223.*
Yellow-throat, western, 116, 118, *377–378.*

Z

Zamelodia melanocephala capitalis, 92, 106, *391.*
Zapus pacificus alleni, 93, 110, *531.*
Zenaidura macroura marginella, 90, 106, *230–232.*
Zones, life, map of, opp. 2; described, 88–97.
Zonotrichia coronata, *428–430.*
  leucophrys gambelii, *432–433.*
  leucophrys leucophrys, 110, *430–431.*
  leucophrys pugetensis, *433.*